SAND2015-9731R

Health and Productivity of Sandia National Laboratories' Workforce: Follow-Up Study

FINAL REPORT

Prepared by the University of Maryland with the

Integrated Benefits Institute

February 2015

Acknowledgement

The researchers want to acknowledge and thank Sandia National Laboratories for their generous funding of this study. We also want to acknowledge that the findings and conclusions presented in this report are those of the research team members alone, and do not necessarily reflect the opinions of Sandia National Laboratories.

Research Team Members

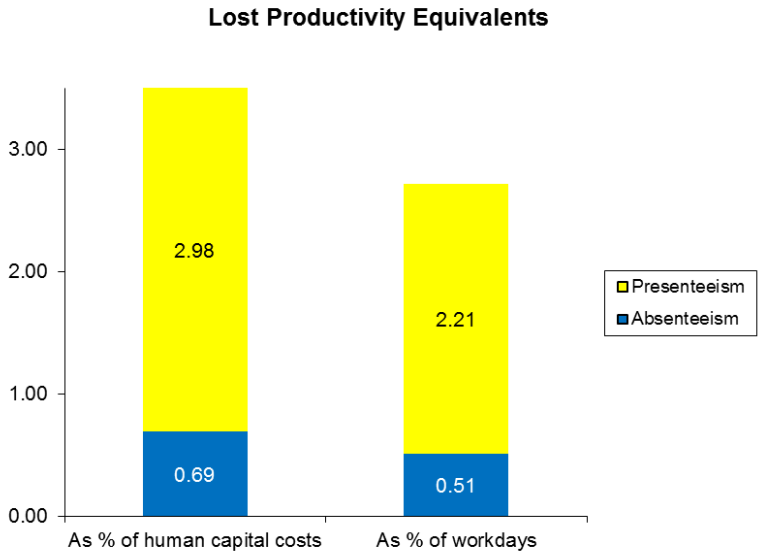
- Jodi Jacobson Frey, PhD — Principal Investigator
- Philip J. Osteen, PhD — Co-Principal Investigator
- Kimberly Jinnett, PhD — Co-Investigator
- Jungyai Ko, MSSW — Co-Investigator

EXECUTIVE SUMMARY

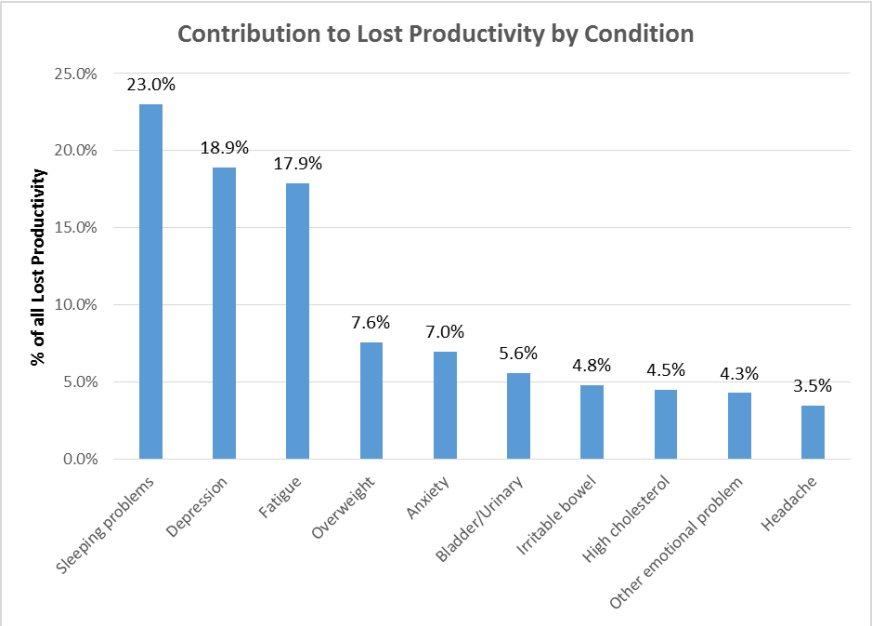
HPQ-Select 2014 Survey Highlights

This Executive Summary provides highlights from the company's full report quantifying the link between health conditions and their business outcomes based on 828 employee survey responses (8% of the workforce) to the HPQ-Select employee questionnaire. These highlights provide key findings on the magnitude of lost productivity, the prevalence of key chronic conditions, their treatment, key conditions driving lost productivity and the potential business impacts of improvements. Details on each of these dimensions can be found in the full report.

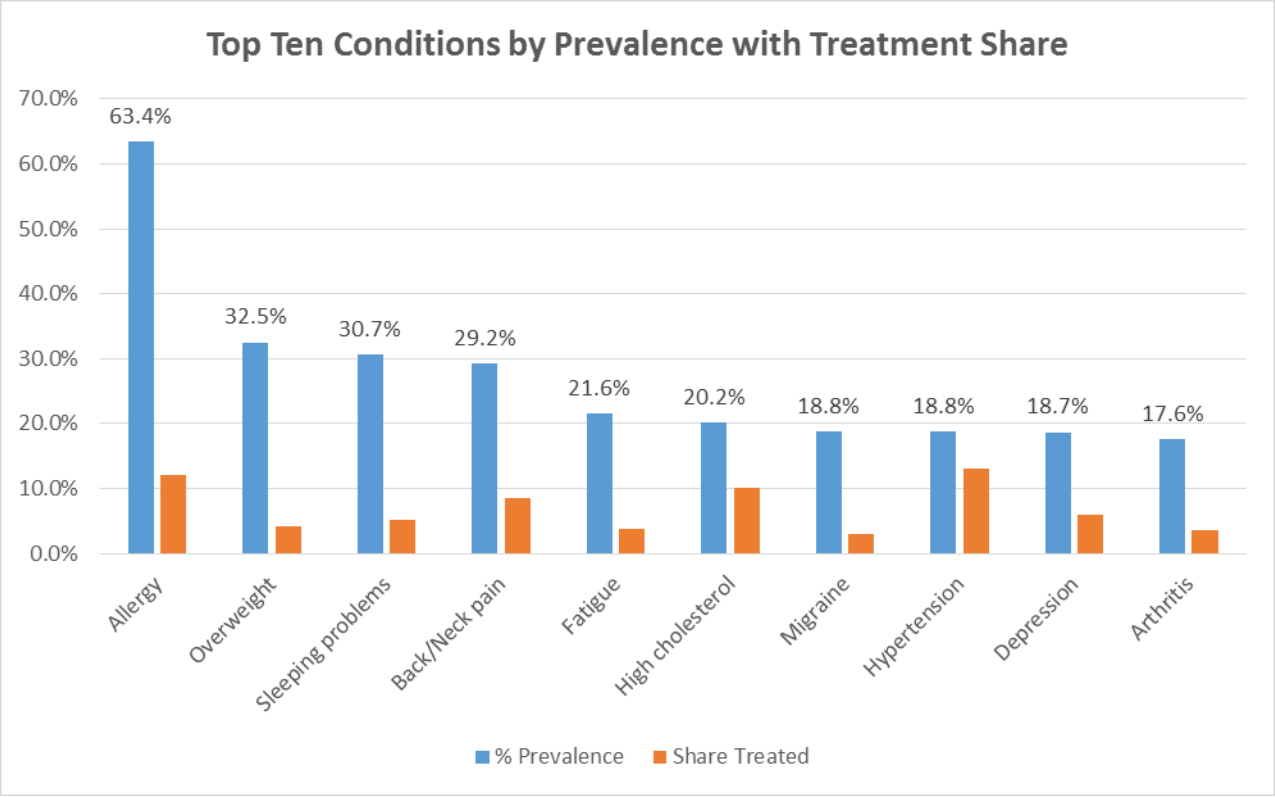
1. Finding: Health-related lost productivity equals $51,147,102 and is a significant business cost for your company. Presenteeism (lost productive capacity due to employee ill health at work) accounts for 81% of this total.



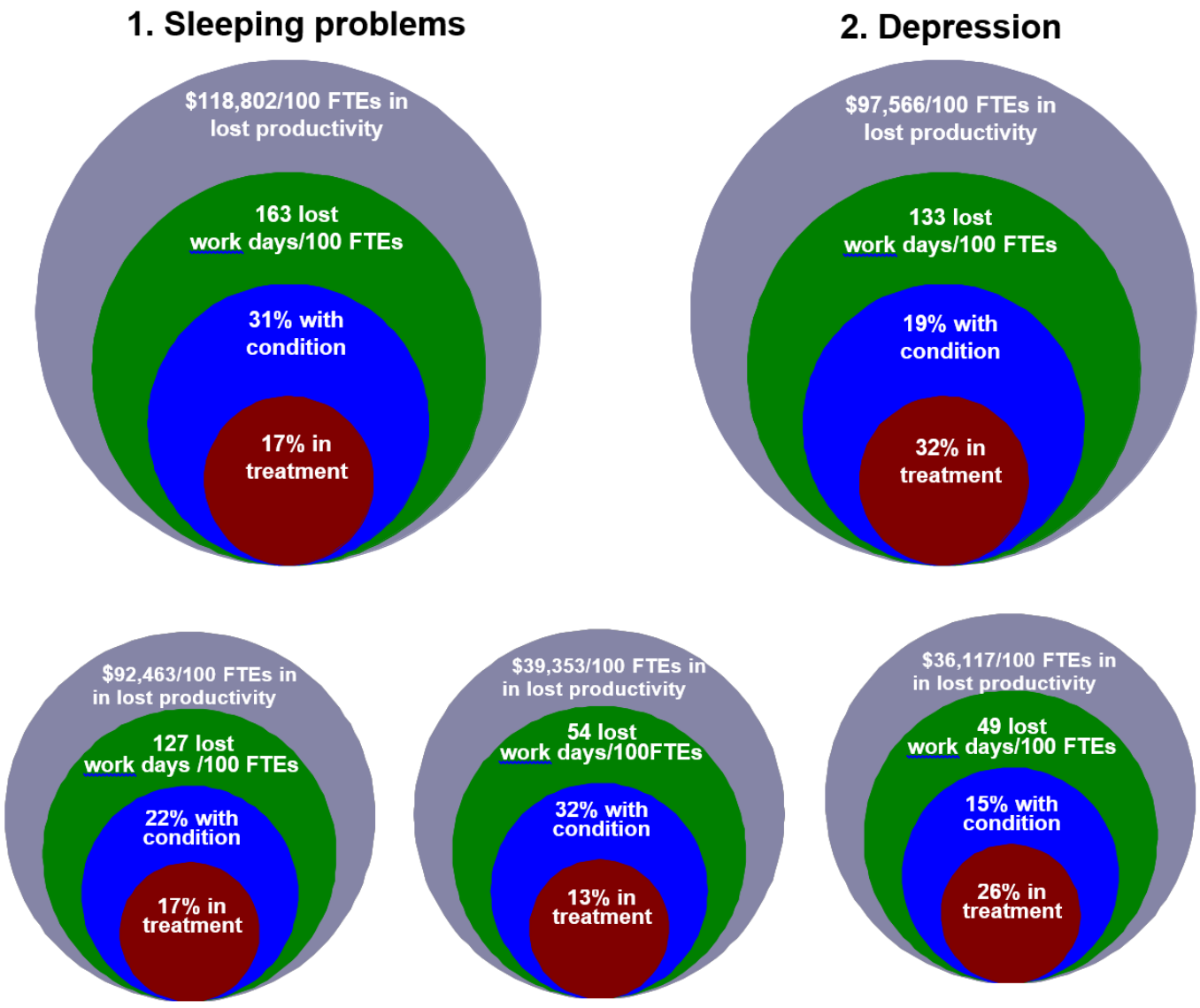
2. Finding: 10 conditions contribute 97% to lost productivity from chronic health conditions and, of these, 5 comprise 74%.



3. Finding: The most prevalent conditions often are not being treated by medical professionals.



4. Finding: The top 5 health conditions driving lost productivity represent significant opportunities for improvements.



5. Finding: Improvements in health-related lost productivity can represent a significant business opportunity.

Savings equivalents in key operational measures for the company

Target Productivity Improvements	Productivity Gains[1]	Added Workdays[2]	Human Capital Growth[3]
1%	$511,471	700	.04%
5%	$2,557,355	3,499	.18%
10%	$5,114,710	6,998	.37%

6. Survey sample: 8% of the company's employees participated in the survey. Respondent characteristics: Average age is 44 years, 57% male, median income is $125,000; 69% of the sample is in the executive, administrator and professional occupational class.

[1] *Productivity gains are calculated as the percent savings in total health-related lost productivity at each improvement level*

[2] *The number of additional workdays that could be funded at each productivity savings level.*

[3] *The percent increase in human capital (wages plus benefits) that could be funded at each productivity savings level.*

Health and Productivity of Sandia National Laboratories' Workforce: A Follow-Up Survey

Section I: Introduction and Methods

Sandia National Laboratories (Sandia) has been concerned about employees' health and well-being, especially as it relates to worker productivity and safety. Additionally, Sandia, similar to other U.S. Department of Energy (DOE) sites, continues to rely on an aging workforce and therefore faces a dual burden as they will need to replace skilled workers and other valued employees in the near future. In fact, 33% of DOE employees were eligible for retirement in 2014 as compared to only 18% in 2010[1]. This potential rapid turnover of the workforce may result in loss of knowledge, talent, and critical skills, in addition to the existing challenges of recruiting and retaining the next generation of engineers, scientists, and other highly skilled workers.

Sandia also recognizes that many employees are choosing to postpone retirement and continue working, even when eligible for retirement, for various reasons. An aging workforce brings additional concerns about increased risk for chronic health conditions and workplace injuries that can negatively affect productivity, as well as other workplace outcomes. Correlations between aging and a gradual decline in physiological domains such as vision, hearing, strength, endurance, and flexibility have been shown to negatively influence worker safety and productivity. It is critical that policies and programs at Sandia support the workforce, regardless of their age, so that employees can perform their jobs safely, while maintaining productivity, overall health, and employee wellbeing.

Over the past several years, Sandia has been responding to the changing needs of its workforce with regard to health and productivity. After completing an initial baseline survey of its workforce in 2011[2][3], Sandia expanded its occupational health and wellness offerings for employees to better respond to employees' chronic health conditions. These programs were designed to improve the health and wellbeing of Sandia employees, and often their family members, and to have a positive effect on productivity, defined as presenteeism and absenteeism. *Presenteeism*, a term referring to the time spent physically at work by employees who are not focusing on work-related tasks, is a more accurate predictor of actual lost work time than absenteeism alone. When presenteeism is considered in calculations of lost work time with traditional counts of absenteeism, estimations

[1] U.S. Department of Energy (2009, October). Department of Energy (Complex Wide). Retrieved from: http://humancapital.doe.gov/resources-workforce-demog-pdfs/1004DOE.pdf

[2] Jacobson, J. M., Osteen, P., Cohen-Callow, A., Jinnett, K., & Ko, J. (2012). *Health and Productivity Questionnaire Survey Report.* Retrieved online: http://energy.gov/ea/downloads/health-and-productivity-questionnaire-hpq-survey-report

[3] Frey, J. J., Osteen, P., Berglund, P.A., Jinnett, K., & Ko, J. (2015). Predicting the impact of chronic health conditions on workplace productivity and accidents: Results from two US Department of Energy National Laboratories. *Journal of Occupational and Environmental Medicine, 57*(3). Available online as pre-print: http://journals.lww.com/joem/pages/issuelist.aspx

of productivity are greatly increased[4,5]. In fact, in the studies that compared productivity resulting from absenteeism and presenteeism, presenteeism created a higher cost burden than absenteeism[6].

As Sandia continues to develop and implement innovative programs to support employees and the overall workplace, the connections between wellbeing and the absence of chronic health conditions on workplace productivity should be regularly assessed. Prior research from 2011 suggested that Sandia was performing very well with regard to the average cost of chronic health conditions on productivity management. In an effort to measure changes in the overall workforce and continue to monitor the effect of chronic health on productivity, Sandia contracted with the University of Maryland to conduct another survey, using the same methods that were used in the 2011 study to prepare an updated report and provide some comparison data, if possible.

In the prior survey, the University of Maryland used a standardized measure of health and productivity, the Health and Productivity Questionnaire Select (HPQ-Select), to collect data from a random sample of permanent Sandia employees. The present study used the same measure and methods, but with a different random sample of the current Sandia permanent employee workforce.

Dr. Jacobson Frey, Principal Investigator (PI) for this study, collaborated with experts from Integrated Benefits Institute and Dr. Philip Osteen at Florida State University, who was employed by the University of Maryland for the original 2011 study, to conduct this study. This follow-up study was approved by both the University of Maryland and the Sandia National Laboratories Institutional Review Boards (IRB; see Appendix A for a copy of the IRB approval letters).

Specific objectives for the present study included:

1. To conduct a cross-sectional survey of permanent Sandia employees to establish the present state of health and wellbeing as it relates to productivity; and
2. To compare results, whenever possible, from data collected in 2014 to data collected in 2011.

[4] Kessler, R.C., Ames, M., Hymel, P.A., Loeppke, R., McKenas, D.K., et al. (2004). Using the World Health Organization Health and Work Performance Questionnaire (HPQ) to evaluate the indirect workplace costs of illness. *Journal of Occupational and Environmental Medicine, 46*(6), 523-537.

[5] Loeppke, R., Taitel, M., Richling, D., Parry, T., Kessler, R. C., Hymel, P., & Knick, D. (2007). Health and productivity as business strategy. *Journal of Occupational and Environmental Medicine, 49*, 712-21.

[6] Goetzel, R. Z., Long, S. R., Ozminkowski, R. J., Hawkins, K., Wang, S. H, & Lynch, W. (2004). Health, absence, disability, and presenteeism cost estimates of certain physical and mental health conditions affecting US employers. *Journal of Occupational Environment, 46*, 898 - 912.

Methods

The researchers employed a cross-sectional research design to collect self-report, anonymous data from permanent employees about their health and productivity. After receiving IRB approval, the study was promoted by Rob Nelson, Director, Health Benefits and Employee Services for Sandia through an email sent to all employees. Two days later, the Principal Investigator (PI) emailed the random sample of permanent Sandia employees and invited them to participate in the survey. The email contained a link to the online informed consent letter and survey. Participation was voluntary and all responses were anonymous. Employees were given the opportunity to contact the PI to request a written survey that would be sent by mail. One employee requested this, but did not return a completed survey. Similar to methods used in 2011, the PI sent three email reminders asking participants to complete the online survey. Data collection concluded on November 25, 2014.

Measurement

Questions regarding safety, specifically injuries, illnesses, or poisonings affecting lost workdays, were included in the survey and reported within the productivity estimations. Data were reviewed within the broader context of employer-level data regarding salaries and benefits to provide a comprehensive picture of health and productivity, measured with the HPQ-Select. The HPQ-Select has been used in different work settings[7,8] and represents the state-of-the-art in reliable and valid indicators of *employee health* (i.e. 29 different health conditions) and *productivity*. Productivity in this study is defined as the combination of absenteeism, presenteeism, and critical incidents.

The original Health and Productivity Questionnaire (HPQ) was developed in partnership with the World Health Organization and Dr. Ronald Kessler, Professor in the Department of Health Care Policy, Harvard University Medical School. It was designed to assess employers' costs associated with employees' chronic health conditions in the workplace. When compared to other existing measures, the newer version of the HPQ, the HPQ-Select, provides a more comprehensive measure of productivity and lost work time related to chronic health conditions and related treatments that are not limited to traditional methods of assessing health care usage, and costs as reflected in medical and pharmacy claims solely.

Over the past several years the HPQ has undergone rigorous psychometric testing to validate the instrument across a diverse range of work organizations and job classifications. One initiative involved a large-scale calibration effort of the survey measuring results against employee data from four different business strata, including airline industry reservation clerks, telecom customer service

[7] Kessler, R. C., Barber, C., Beck, A., Berglund, P., Cleary, P. D., McKenas, D., et al. (2003). The World Health Organization Health and Work Performance Questionnaire (HPQ). *Journal of Occupational and Environmental Medicine, 45*(2), 156-174.

[8] Scuffham, P.A., Vecchio, N., Whiteford, H.A. (2014). Exploring the validity of HPQ-based presenteeism measures to estimate productivity losses in the health and education sectors. *Medical Decision Making, 34*, 127-37.

representatives, auto-manufacturing executives, and railroad engineers[6]. Found to be reliable and valid, the HPQ has also been used to assess modifiable risk health concerns such as cardio-respiratory fitness and obesity among American workers[9].

The HPQ-Select survey takes approximately 10 minutes to complete and can be done online or via a paper survey. The survey assesses 29 chronic health conditions using a 4-point rating scale. The survey also includes questions related to accidents, injuries, and work performance, as well as employee demographics. Keeping the survey the same as 2011, the researchers included two validated national survey items from the National Health Interview Survey (NHIS) to estimate the prevalence of smoking among employees[10]. Additionally, the original HPQ-Select question related to job classification was modified to parallel the new job categories used by Sandia.

Population and Sample

The researchers selected a total random sample of 3000 employees for the study from a list of 9,890 permanent employees furnished by Sandia. The sample was constructed based on two criteria: (1) enroll a sufficient number of participants to achieve statistical power, and (2) draw proportionally equal subgroups based on employees' age. The developers of the HPQ-Select recommend that the final sample size exceed a minimum of 500 participants in order to identify any trends involving low-prevalence chronic health conditions measured by the HPQ-Select.

Based on an estimated minimum survey return rate of 25%, an initial sample of 2000 (500*4) employees were identified for the study. This minimum response rate was determined by the researchers in collaboration with Sandia and was based on employees' response to prior worksite surveys, in addition to considering the sensitive nature of the survey questions. Prior to selecting the study sample, employees were classified according to the following three age categories: ≤ 34 years old, 35-49 years old, and ≥ 50 years old. Employees were then randomly sampled and recruited from each age group. It was decided at the end of the original recruitment period to draw a second age-stratified random sample of 1000 employees to ensure that the minimum level of data required for sufficient statistical power was collected. Because both samples were randomly drawn from the same population they can be considered a single sample.

This sampling frame represents approximately 48% of employees ≤ 34 years old (1000/2077), 22.5% of employees 35-49 years old (1000/4450), and 29.7% of employees ≥ 50 years old (1000/3362).

Eight hundred twenty-eight completed surveys could be used for data analysis for a final response rate of 27.6%. The estimated minimum response rate for this survey was 25%. To run the analysis, the researchers needed a minimum of 500

[9] Pronk, N. P., Martinson, B., Kessler, R. C., Beck, A. L., Simon, G. E., & Wang, P. D. H. (2004). The association between work performance and physical activity, cardiorespiratory fitness, and obesity. *Journal of Occupational and Environmental Medicine, 46*, 19-25.

[10] U.S. Centers for Disease Control and Prevention. (2007). National Health Interview Survey. Retrieved from http://www.cdc.gov/nchs/nhis/2007paradata.htm.

completed surveys. A detailed description of the sample characteristics as compared to the overall workforce[11] is displayed in Table 1 below. Data analysis was based on results from 828 completed surveys weighted to the socio-demographic characteristics (age, gender and occupation distribution) of the overall workforce.

Table 1: 2014 Sample Characteristics

DOE CONTRACTOR WORKSITE		Population	Sample	Population	Sample
Year		2014	2014	2011	2011
Total Workers		9890	828	8632	901
Demographics		% of Population	% of Sample	% of Population	% of Sample
Gender	Men	68%	57%	64%	68%
	Women	32%	43%	36%	32%
Occupation	Executive/Administrator/ Senior Manager/Professional	69%	69%	70%	72%
	Technical Support/Precision Production & Craft Workers	14%	16%	7%	11%
	Sales/Clerical & Administrative Support	11%	12%	11%	14%
	Service Occupations/Operator & Laborer	6%	3%	12%	3%
Age	≤34	21%	30%	23%	30%
	35 to 49	45%	32%	34%	35%
	≥50	34%	39%	43%	35%
Annual Income	<$25,000	0%	2%	5%	1%
	$25,000 - $49,000	9%	0%	13%	1%
	$50,000 - 74,000	21%	21%	21%	10%
	$75,000 - 99,000	22%	27%	23%	38%

[11] Note that not all demographics and workforce characteristics were available to the research team.

	>=$100,000	48%	50%	38%	51%
Work Status	Full-Time	†	97%	†	92%
	Part-Time	†	3%	†	8%
Employment Type	Salaried	†	74%	†	76%
	Paid Hourly	†	26%	†	24%
Union Membership	No	†	94%	†	92%
	Yes	†	6%	†	8%
Highest Education	High school graduate or GED	†	3%	†	3%
	Some college or 2yr graduate	†	17%	†	19%
	4yr college graduate	†	14%	†	11%
	More than 4yr college graduate	†	66%	†	67%
Race	White, not Hispanic	†	77%	†	73%
	Black, not Hispanic	†	1%	†	1%
	Hispanic	†	16%	†	17%
	Asian or PI	†	2%	†	3%
	Other	†	4%	†	5%

† data not currently available

Note: There were some statistically significant differences between the expected and observed demographics for the 2014 sample. These differences are discussed in the Limitations Section of this report.

Section II: Results

This report quantifies the link between chronic health conditions and their business outcomes based on 828 employee survey responses to the HPQ-Select questionnaire. It is intended to help the employer broaden the data on the true costs of employee health and to promote new strategies for managing chronic medical conditions. The report summarizes information gathered from employees completing the HPQ-Select survey instrument and details the prevalence and treatment penetration of chronic health conditions in the workforce; integrates information on lost work time and chronic conditions; quantifies the amount of lost productivity associated with that lost work time; and summarizes opportunities to improve business performance through productivity gains.

Principle Findings

The magnitude of health-related lost productivity costs for chronic conditions is too large to ignore. Health-related lost productivity in this workforce equals $51,147,102. Lost productivity costs are equal to 3.7% of human capital costs in the business.

Improvements in lost productivity can represent a significant business opportunity. Every company desires to improve productivity. A 10% improvement in health-related productivity would be equivalent to adding 6,988 work days.

The most prevalent chronic conditions often aren't treated by health professionals. The five most common chronic conditions are Allergy, Overweight, Sleeping problems, Back/Neck pain and Fatigue. On average, these conditions are treated professionally only about 19% of the time. These results underscore the need for employers to look beyond medical and pharmacy claims data to manage chronic conditions.

The best productivity-improvement opportunities can be found by focusing on a core group of key chronic health conditions. Employers may be hesitant to expand medical treatment due to concerns over medical costs. However, when employers link chronic conditions to time loss from work and its productivity consequences, they may re-think their health management strategies. The data show that not every chronic health condition contributes the same amount to lost productivity and thus represents an opportunity to drive overall gains. The five most important chronic conditions for this workforce from a lost work time perspective: (1) Sleeping problems, (2) Depression, (3) Fatigue, (4) Overweight, and (5) Anxiety. These five conditions represent 74% of all lost productivity, while the top 10 chronic account for 97%.

Respondents: 8% of the company's workers participated in the HPQ-Select survey. The employees participating in the survey have the following characteristics compared to the full workforce. The results in this report represent survey respondents weighted to the socio-demographic characteristics (i.e. age, gender and occupation distribution) of the overall workforce.

Sample Comparison: 2011 and 2014: Direct individual-level comparisons between the results from the 2011 and 2014 studies are not possible due to the anonymity of the data. In the absence of identifying individual information, it is not possible to link

respondents in the 2014 sample to respondents in the 2011 sample. In certain instances the researchers attempted to make direct comparisons when possible by controlling for age and gender. Results suggest that employees selected for the 2014 sample had greater rates of absenteeism and presenteeism resulting from their health conditions, as compared to employees in the 2014 sample.

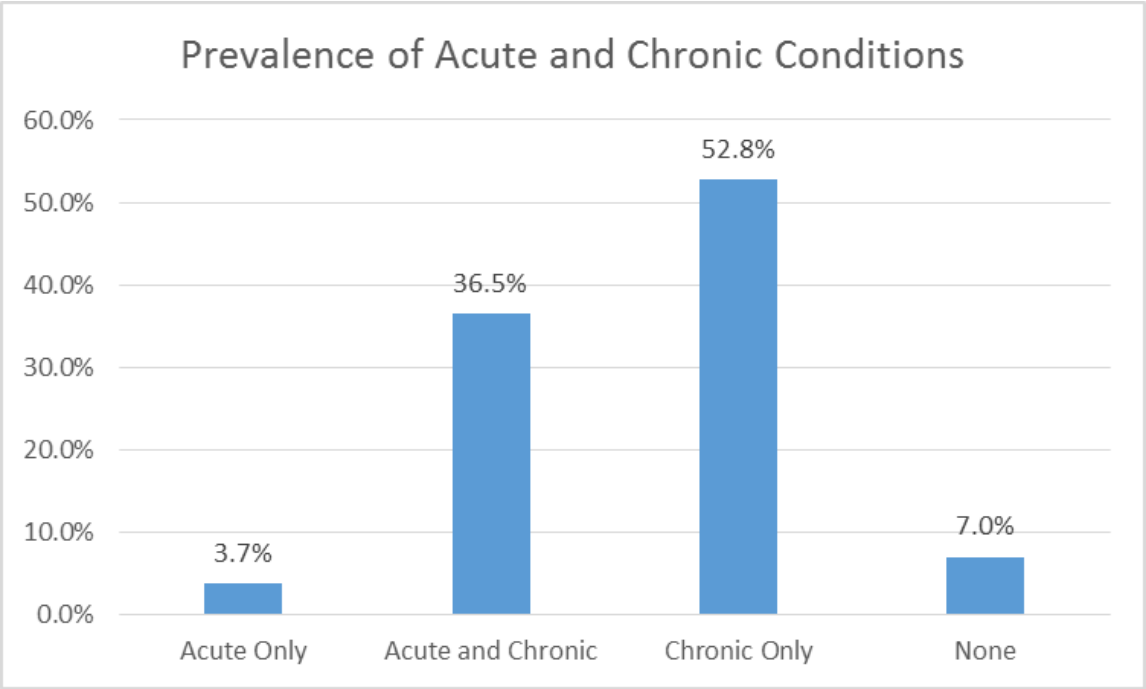
Results Part I. Health Conditions and Their Treatment

Employers historically have managed health care by focusing on high-cost conditions identified in medical and pharmacy claims files. Although an important starting point, medical and pharmacy claim databases miss two important aspects of employee health: (1) they only include conditions for which medical care is provided and a medical claim generated and (2) they may exclude conditions that are symptomatic of broader health issues and cannot be narrowly defined with a diagnosis code, yet significantly affect employee productivity.

This report includes analysis of the following 29 chronic health conditions: alcohol or drug problems, allergy, anxiety, arthritis, asthma, back/neck pain, bladder/urinary, bronchitis, chronic obstructive pulmonary disease (COPD), congestive heart failure, coronary heart disease, depression, diabetes, fatigue, gastroesophageal reflux disease (GERD), headache, high cholesterol, hypertension, irritable bowel syndrome, migraine, nicotine dependency, overweight, osteoporosis, other cancer, other emotional problem, skin cancer, sleeping problems, and ulcer.

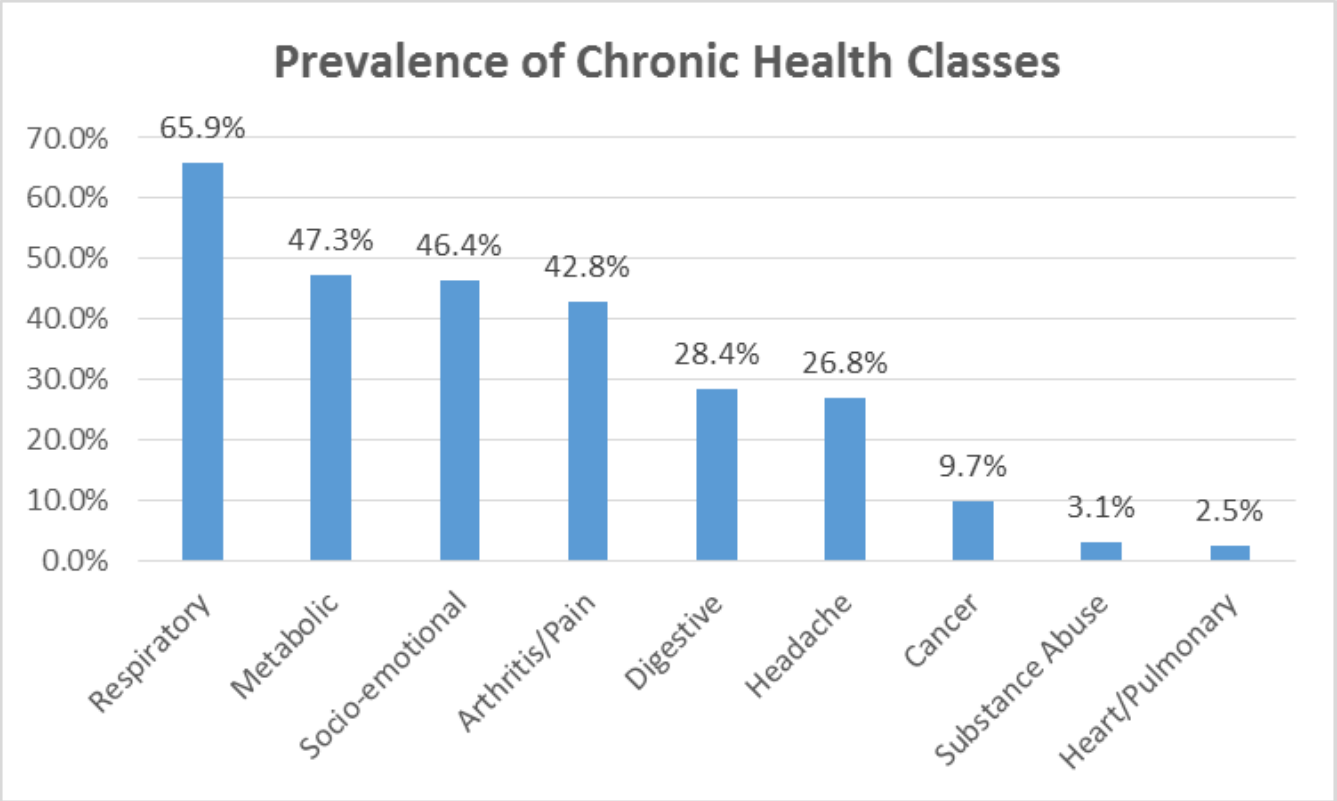
This section highlights findings from the analysis for the following dimensions: chronic conditions relative to acute conditions (such as colds, flu, injuries, etc.); prevalence and treatment penetration for chronic conditions in the workforce reflected in broad health classes (such as respiratory conditions and socio-emotional problems); individual chronic conditions and co-morbid pairs of conditions; and opportunities to improve care by closing the treatment gap for important conditions.

A. Acute vs. chronic conditions. Although treatment for acute conditions may be reflected in medical and pharmacy claims databases, acute conditions rarely represent a dominant share of medical conditions or medical costs for an employer. This exhibit shows the relative importance of acute vs. chronic conditions Sandia.



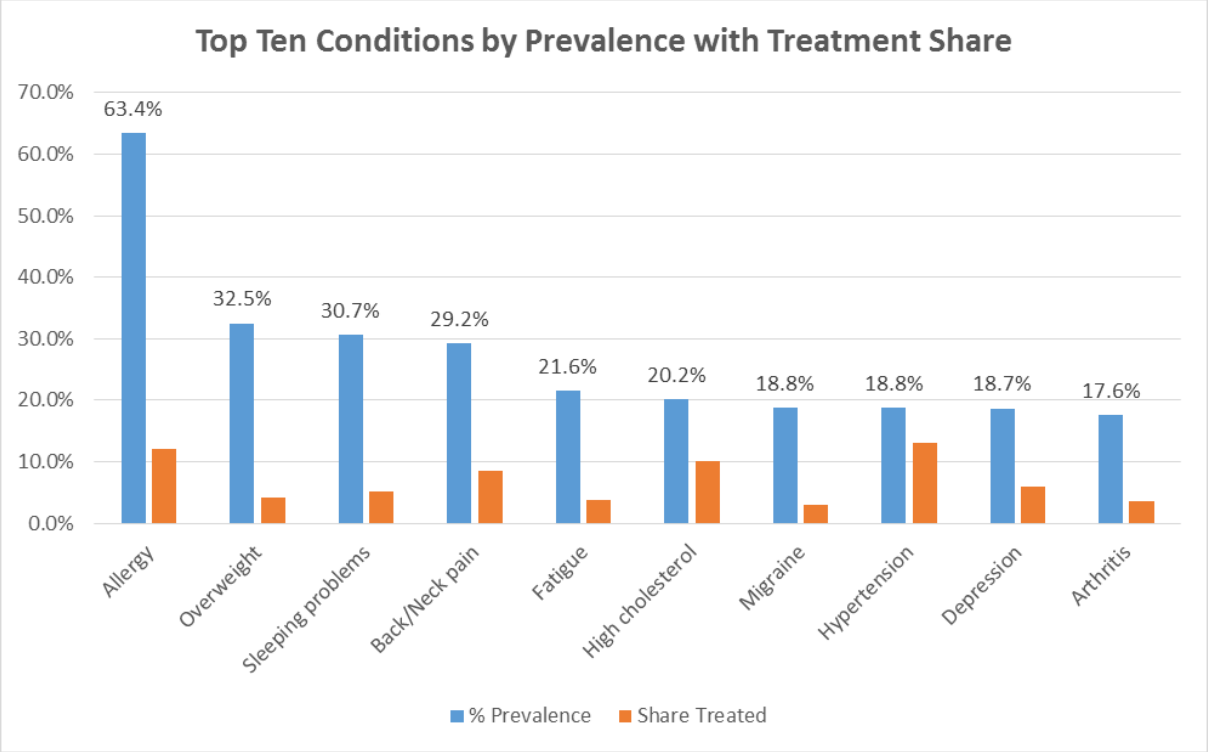
Key Findings: 89% of the workforce suffers from chronic health conditions, either alone or in combination with acute conditions.

B. Chronic health groupings. The first step in understanding the range of chronic health conditions in the workforce is to examine the broad health classes into which they fit. The exhibit below shows the prevalence of chronic conditions by nine key health-condition classes as reported by survey participants.



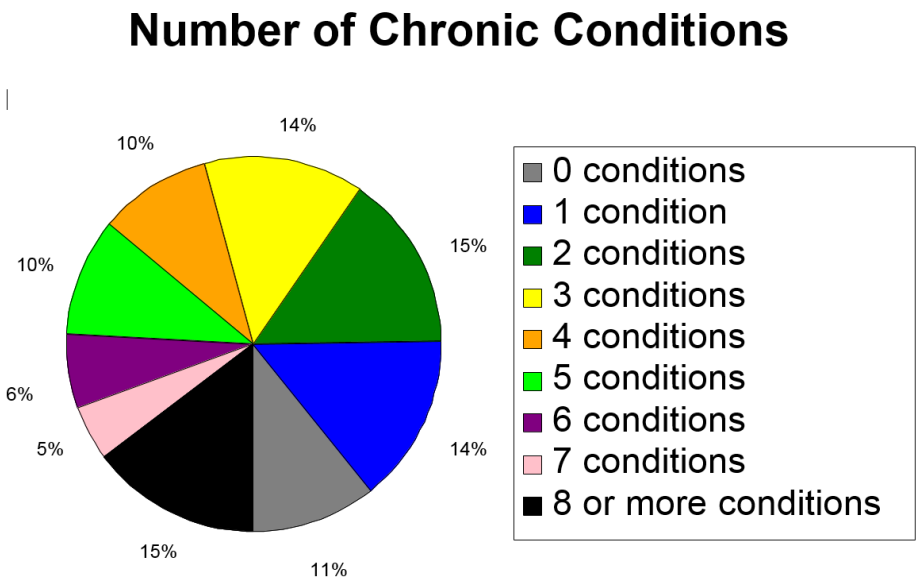
Key Findings: The workforce's prominent chronic conditions can be clustered into nine groups by way of prevalence in the workforce: Respiratory (66%), Metabolic (47%), Socio-emotional (46%), Arthritis/Pain (43%) and Digestive (28%). The least common chronic condition is Heart/Pulmonary (3%).

C. Health conditions in the workforce. Health-condition classes are helpful to get an overview of the range of chronic conditions. However, treatment and other interventions target discrete health conditions. The exhibit below displays the 10 most prominent chronic health conditions ranked by their prevalence in the workforce during the survey period and, for each condition, the proportion of cases for that condition being treated by medical professionals.

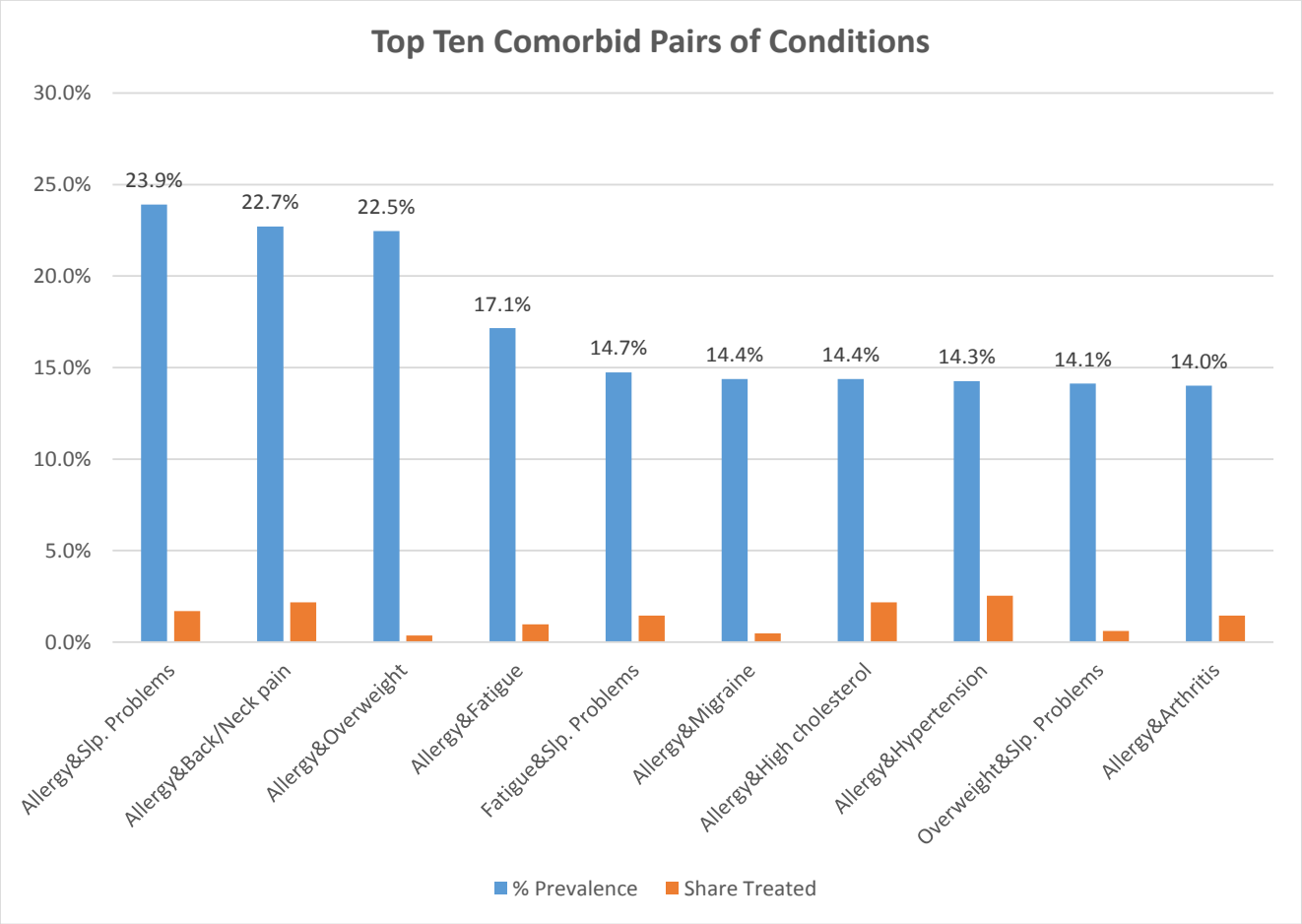


Key Findings: In the workforce studied, Allergy is the most common health condition with a prevalence of 63%, while only 19% of Allergy sufferers report being treated currently. On the other end of the spectrum, 18% of the workforce has Arthritis and 21% are being treated. Over all 29 conditions analyzed, an average of 29% were being treated at the time of the study.

D. Co-morbid groups. Finally, chronic conditions often exist in combinations; as the employer develops intervention strategies it may want to consider these broader classes. The following exhibit shows the number of chronic conditions in the workforce; the next bar chart displays the five most prominent co-morbid pairs of conditions and shows the treatment penetration for each.



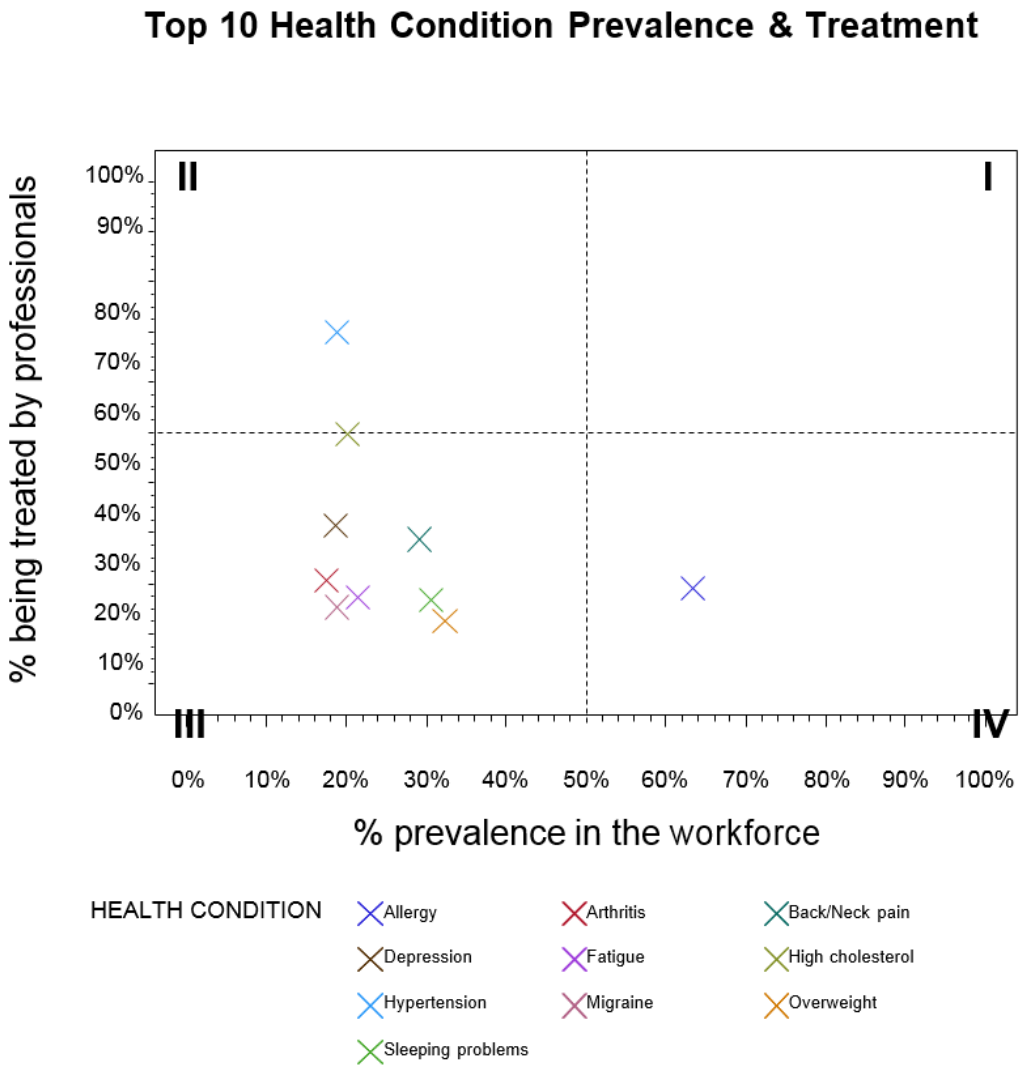
Average number of chronic conditions per employee = 4.0



Key Findings: Sleeping problems & Allergy is the most common co-morbid pair of chronic health conditions with a 24% prevalence rate; of the employees with these two conditions, only 7.1% of the employees are being treated by medical professionals. Ranked tenth is Allergy & Arthritis with a prevalence of 14%; 10% with these conditions are being professionally treated for these two conditions.

E. Opportunities to improve treatment of chronic conditions. Closing the gap in treatment for the most common conditions is often a goal of chronic medical care. The exhibit below shows the top 10 health conditions based on the combination of percent prevalence in the workforce (shown on the horizontal axis) and percent in treatment (shown on the vertical axis). The Appendix provides a listing of prevalence and percent treated for all health conditions surveyed.

Conditions in quadrant I are those that are highly prevalent and have a large percent being treated by medical professionals; those in quadrant II are less prevalent but still have a large percentage being treated. Quadrant III includes condition with lower prevalence and lower treatment penetration, while Quadrant IV includes conditions with high prevalence and low treatment penetration.

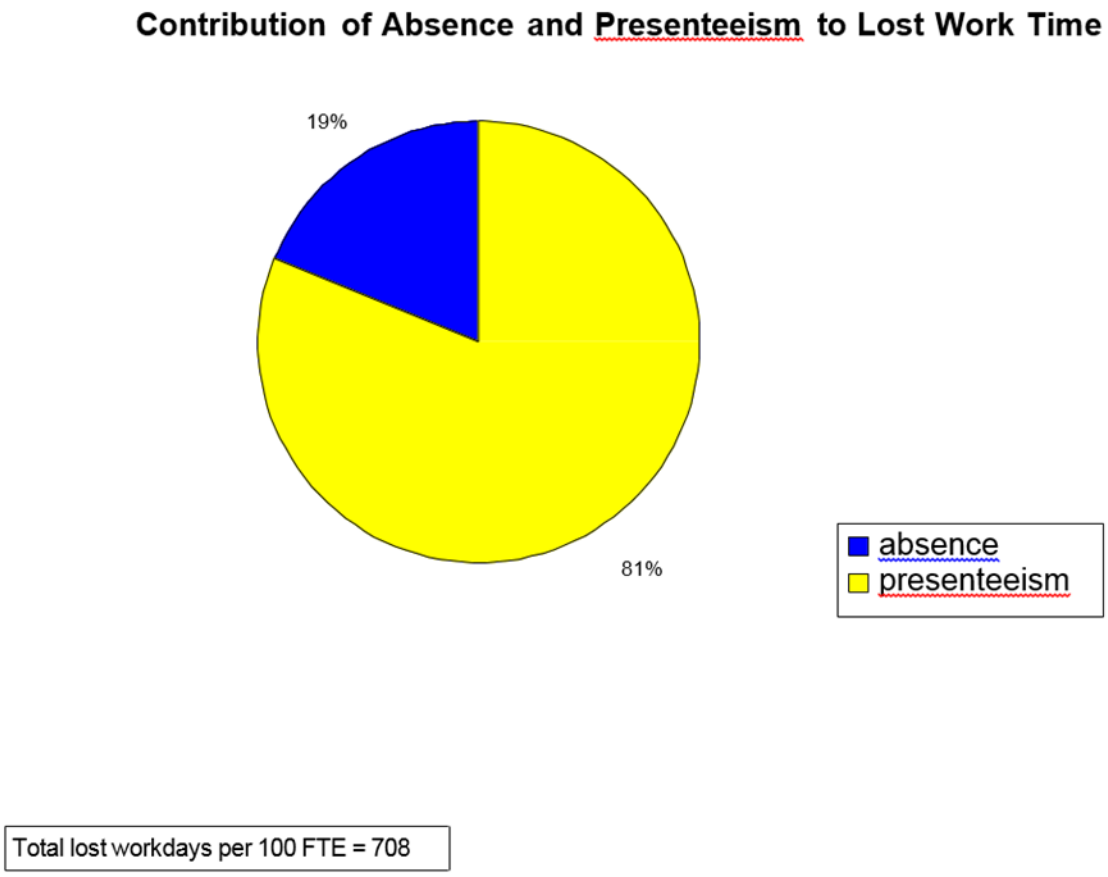


Key Findings: The best opportunities to improve treatment are a function both of the prevalence of the condition in the workforce and the degree to which the condition is being treated. Conditions in quadrants III and IV tend to be the best targets for taking action.

Results Part II. The Link between Chronic Conditions and Lost Work Time

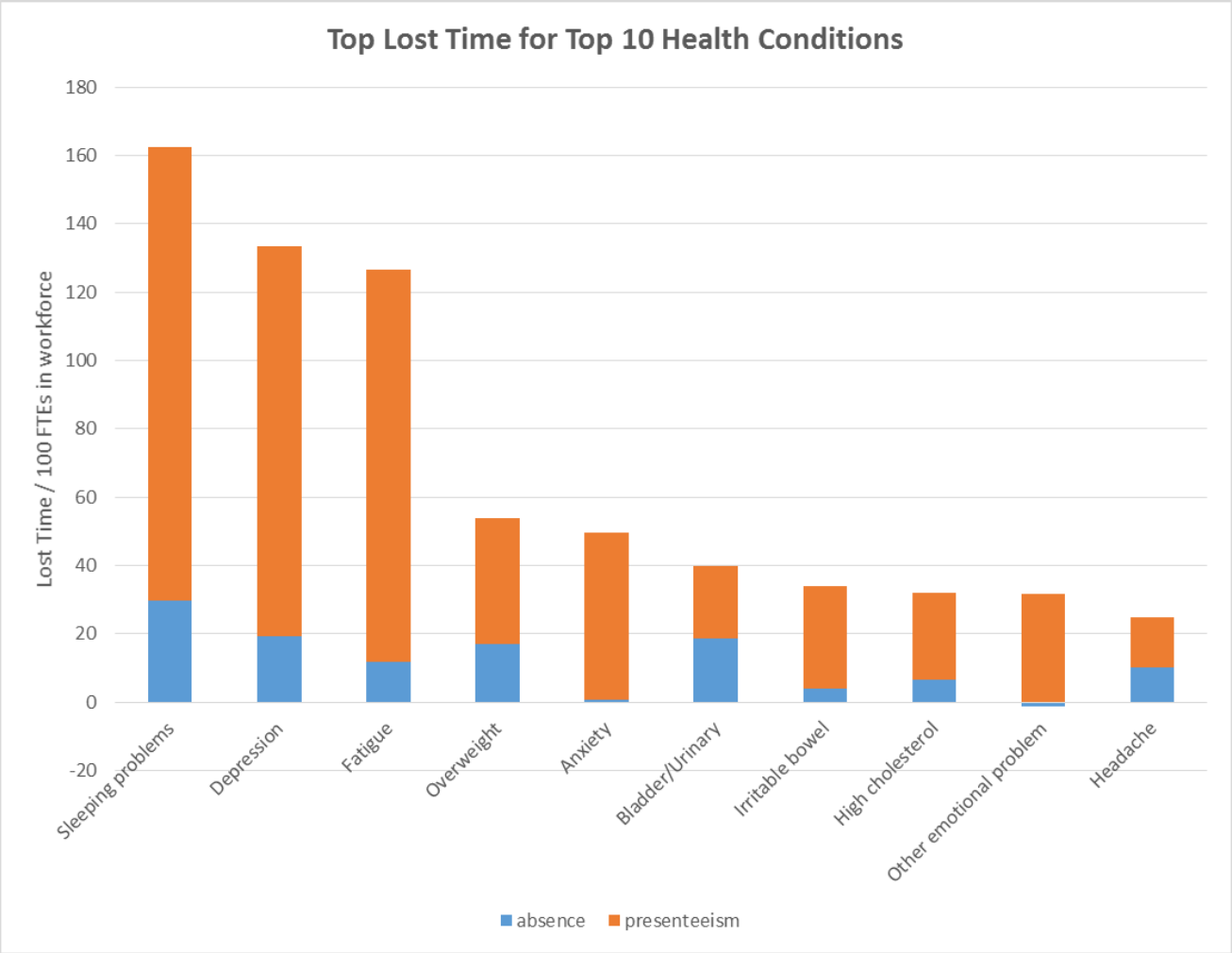
Time away from work links chronic conditions to lost productivity. We examine the amount of lost work time associated with chronic health conditions in two forms: (1) absence from work and (2) reduced performance while at work resulting in lost work time (presenteeism).

A. The Magnitude of Lost Work Time and its Contributors. The relative magnitude of these two components of time away from work will influence the employer's strategy in both health and lost-time management. This exhibit shows the relative contributions of absenteeism and presenteeism to total lost work time for the workforce.



Key Findings: Presenteeism lost time accounts for 81% of the 708 total lost workdays per 100 full-time equivalent employees in this workforce.

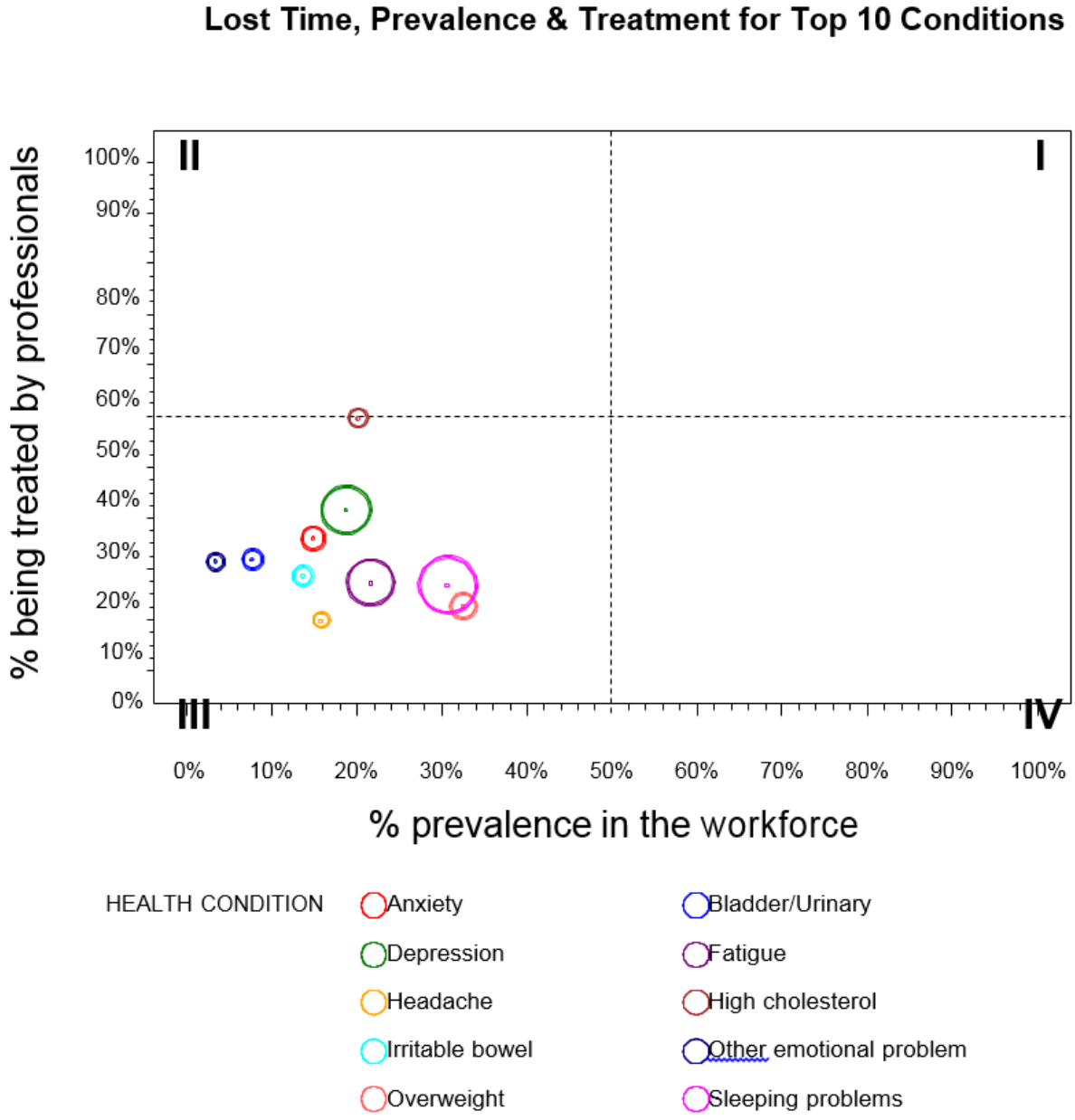
B. Chronic Conditions and Lost Work Time. Developing strategies for managing total time away from work due to chronic conditions requires the employer to link individual conditions to lost work-time outcomes. The following exhibit displays the amount of absenteeism and presenteeism for each of the top 10 health conditions ranked by total time loss from work (see Appendices 2 and 3 for a complete list of all health conditions and the amount of lost time associated with each).



Key Findings: Sleeping problems (163 days/100 FTEs) and Depression (133 days/100 FTEs) are the two biggest contributors to lost work time for chronic conditions. Presenteeism accounts for 82% of the lost time for Sleeping problems and 86% for Depression. Fatigue is ranked third in importance from a lost-time perspective.

C. Opportunities for Improvement. We expand the exhibit from the previous section on opportunities to improve chronic care by including lost work time - a key factor in lost productivity. Opportunities for improvement in this broader perspective are a function of prevalence of the condition in the workplace, the degree to which the condition is being treated and the lost time associated with the condition.

Similar to the exhibit on opportunities for improvement in the previous section, we show the prevalence-treatment relationship for each of the 10 chronic conditions (with quadrant numbers showing prevalence-treatment relationships), but this exhibit is ranked by total lost work time. The size of the bubble at the prevalence-treatment nexus represents the amount of time loss for each condition (larger bubbles indicate conditions with more lost time). The center point in the bubble represents the intersection of prevalence and treatment on the X and Y axes. Knowing the prevalence-treatment-time loss will help focus the employer on where the best improvement opportunities exist.



Key Findings: The inclusion of lost work time as a key factor in the broader opportunities to improve care changes some of the top-10 conditions (conditions with relative high prevalence and low treatment penetration - but little lost time -may drop out

of this exhibit). Conditions in quadrants III and IV tend to be conditions with low treatment penetration and increasing prevalence in moving from quadrant III to IV. Conditions with larger bubble sizes in these quadrants represent the best opportunities to improve lost work time through better care. For this group of employees, Sleeping problems, Depression and Fatigue conditions may be good targets for interventions.

Results Part III. Lost Productivity and Business Impacts

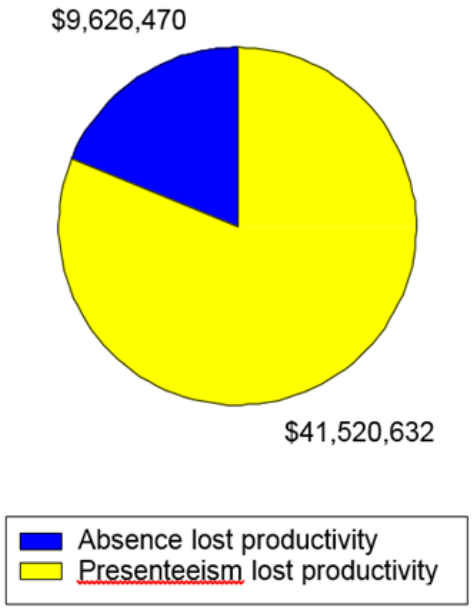
The ability of a company to make the business case for the value of health will depend on the ability of benefits/risk professionals to translate the impacts of chronic health conditions into terms consistent with senior management's activities. This final section of the report translates absenteeism and presenteeism lost work time into financial lost productivity, which reflects lost productivity that may be more relevant to the Board of Directors and Chief Executive Officer, Chief Financial Officer and Chief Operating Officer. Additionally, this reflects opportunities to improve productivity using key business metrics for each level of the organization.

A. The Magnitude of Health-related Lost Productivity. Lost productivity resulting from chronic health conditions can most straightforwardly be quantified as the opportunity costs of ill health of its employees. Research[12] shows that these costs are a function of: (1) the amount of time lost from work due to absenteeism and presenteeism, (2) the amount employees are remunerated for their labor (based on salary and benefits) as a measure of their 'direct value' to the business and, (3) the labor-output relationship (which is related to the ease with which labor can be replaced; the time value of output; and the degree to which employees work in teams).

This exhibit displays how much productivity is lost from all 29 chronic health conditions in the company and how absenteeism and presenteeism contribute.

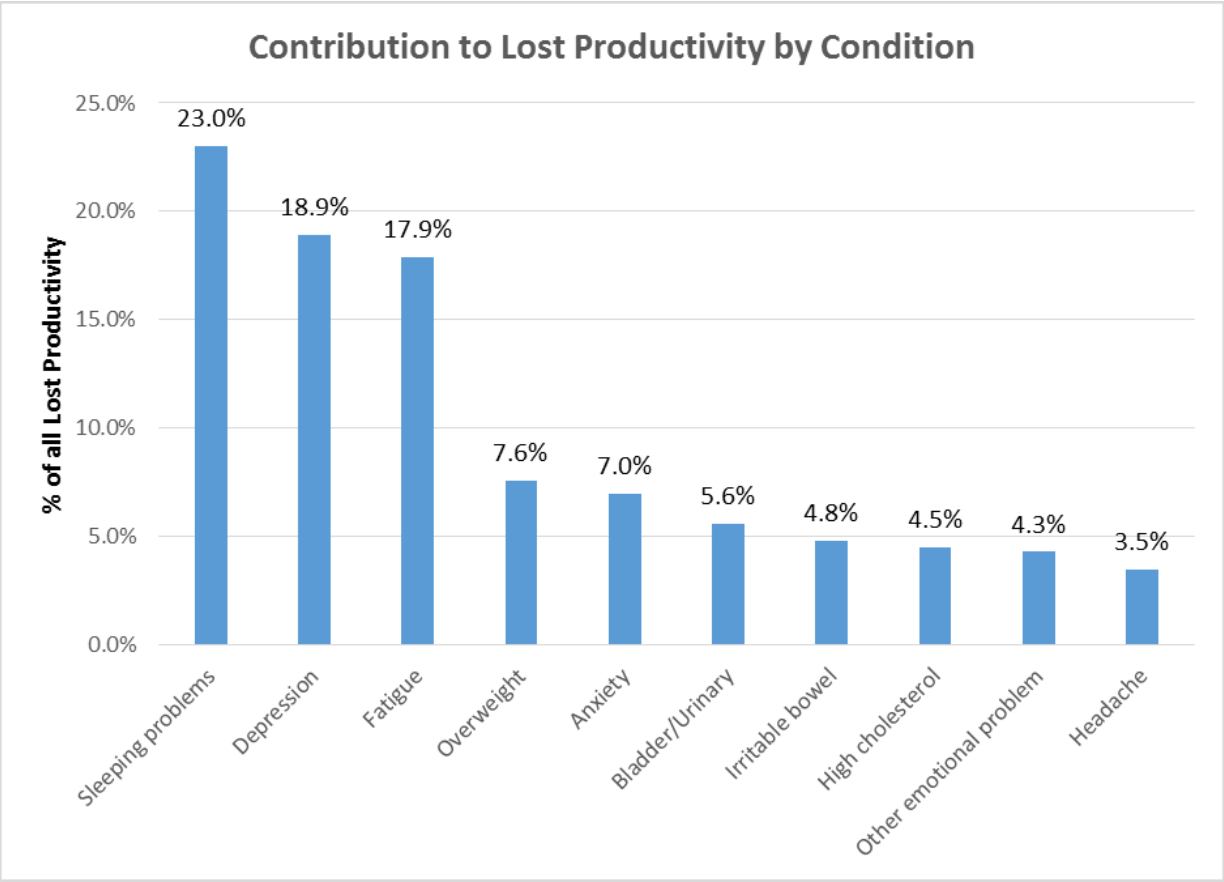
[12] Nicholson, S, Pauly, M, Polsky, D, Baase, C, Billotti, G, Ozminkowski, R, Berger, M, & Sharda, C. (2005). How to Present the Business Case for Healthcare Quality to Employers. *Applied Health Economics & Health Policy*, *4*(4), 209-218.

Amount of Absence & Presenteeism Lost Productivity



Key Findings: Lost productivity resulting from presenteeism accounts for $41,520,632 of the $51,147,102 of health-related lost productivity in the workforce from chronic diseases.

B. Lost productivity and health conditions. How do individual health conditions contribute to health-related lost productivity? The amount of lost productivity by condition will help the employer focus on where to spend limited resources with potentially the greatest returns. The exhibit below displays the contribution to lost productivity for the top 10 health conditions.



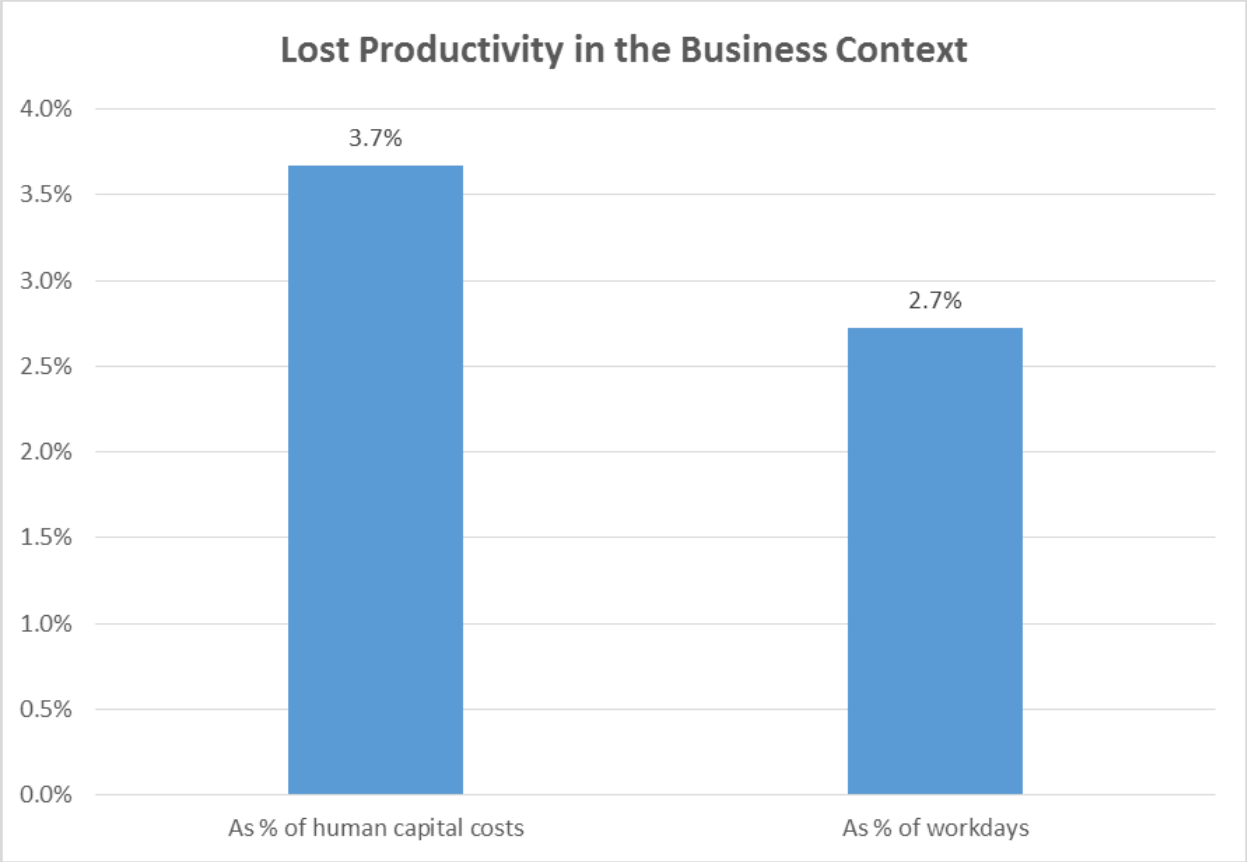
Key Findings: The two most important health conditions from the lost-productivity perspective are Sleeping problems (accounting for 23% of the $51,147,102 in lost productivity) and Depression (contributing 19%).

C. Lost Productivity in the Business Context. The importance of lost productivity and its potential in improving business performance is reflected in its magnitude relative to key operating metrics in the business. At the same time, what are considered 'key operating metrics' varies by the interests of those with different organizational roles and responsibilities. For example, the Board of Directors may be particularly interested in maintaining the company's assets - including its human capital assets - under its Sarbanes-Oxley responsibilities. The Chief Financial Officer may be concerned primarily with strategies to grow earnings, while the head of operations is focused on ensuring that there are sufficient workers to produce the company's goods and services. Improving health-related lost productivity can lead to gains in each of these three areas.

As a reference point, the following exhibit shows the company's numbers for each of these perspectives.

Organization Level	Operational Concern	Key Measure	Company Values
Board of Directors	Asset maintenance	Human capital investment	$1,392,162,659
Chief of Operations	Workflow	Size of workforce	$9,890

The following exhibit shows the magnitude of health-related lost productivity relative to these key measures for your company.



Key Findings: Lost productivity is significant relative to these key operational metrics. It represents 3.7% of human capital costs and the time loss associated with this lost productivity is the equivalent of 2.7% of available work days.

D. The Business Impact of Improvements. The final step in understanding the meaning of lost productivity is to analyze potential impacts of lost productivity improvements in these business metrics. The exhibit below shows overall productivity improvements of 1%, 5% and 10% relative to these three operational levels.

Savings equivalents in key operational measures for the company

Target Productivity Improvements	Productivity Gains[1]	Added Workdays[2]	Human Capital Growth[3]
1%	$511,471	700	.04%
5%	$2,557,355	3,499	.18%
10%	$5,114,710	6,998	.37%

Key Findings: From the perspective of different levels of the organization, improving health-related lost productivity can help improve business results. For example, a 10% productivity improvement in the work force translates to an equivalent of 0.37% gain in human capital assets and could contribute an additional 6,998 workdays to assist in delivering the company's products and services.

[1] *Productivity gains are calculated as the percent savings in total health-related lost productivity at each improvement level*

[2] *The number of additional workdays that could be funded at each productivity savings level.*

[3] *The percent increase in human capital (wages plus benefits) that could be funded at each productivity savings level.*

Results Part IV: 2011 and 2014 Sample Comparisons

Differences between employee survey responses in CY[13] 2014 and CY 2011

This section outlines differences between the employee survey samples in CY 2011 and CY 2014. Although there may be some overlap of individuals between the sample in CY 2011 and 2014, the study was not designed to allow tracking of individuals; therefore, samples should be considered independent of one another. The differences highlighted in this section represent observed differences between the two overall samples completing the survey in CY 2011 and CY 2014. Where higher prevalence levels are noted it simply indicates a higher percentage of individuals in CY 2014 reported those conditions compared to individuals in CY 2011. The researchers can say CY2014sample has more illness based on these findings. But higher prevalence of health conditions in the 2014 sample could be due to those who were not in the 2011 sample. The researchers have no way of parsing the repeat cohort from the new entrants.

Simple mean difference tests were conducted across all demographic, condition and treatment variables in the dataset. Based on a set of simple mean difference tests between CY 2011 and CY 2014, the researchers found that there was a higher percentage of females in CY 2014 compared to CY 2011, 43% versus 36% respectively ($p<.05$). What follows are the remaining differences across chronic conditions and treatment rates.

Chronic Conditions and Treatment

In Table 2 below, simple mean difference tests by year ($p<=.05$) are shown and the researchers found significantly higher rates of Arthritis and Depression in the CY 2014 sample. While those conditions have higher prevalence, Nicotine Dependency is lower in CY 2014 (2.7% vs. 5.6%). The researchers also found that treatment for Chronic Pain is higher in the CY 2014 group at 26.4% compared to 16.9% in the CY 2011 group. Finally, treatment for Any Condition was also higher in 2014 at 49% compared to 43% in CY 2011.

[13] CY = Calendar Year

Table 2. Significant differences between years at *p*<=.05

Calendar Year	Arthritis	Depression	Nicotine dependency*	Chronic pain treatment*	Any treatment*
CY2014 (*n*=828)	17.6%	18.7%	2.7%	26.4%	48.7%
CY2011 (*n*=819)	15.8%	14.4%	5.6%	16.9%	43.2%

*Highlighted cells indicate lower prevalence or higher treatment rates in CY 2014 compared to CY 2011.

Table 3 below presents simple mean difference tests by year (*p*<.05 and <=.10) and reports ***marginally significant*** findings. Across the CY 2014 sample prevalence for Migraine, Chronic Pain and Skin Cancer is higher than in CY 2011. Overall, we also found a marginally significant difference in the number of illnesses among the CY 2014 group compared to the CY 2011 group where the average was 4.0 versus 3.7 respectively. The researchers did find that treatment for back/neck pain and fatigue were higher among the CY 2014 group than the CY 2011 group (*p*<=.10).

Table 3. Marginally significant differences between years at p<=.10

Calendar Year	Migraine	Chronic pain	Skin cancer	Back/Neck pain treatment*	Fatigue Treatment*	Number of illnesses
CY2014 (*n*=828)	18.8%	13.3%	7.1%	28.9%	17.3%	4.0
CY2011 (*n*=819)	14.9%	10.2%	5.5%	21.7%	11.0%	3.7

*Highlighted cells indicate lower prevalence or higher treatment rates in CY 2014 compared to CY 2011.

The researchers can confidently say based on the illnesses surveyed that the CY 2014 group has more chronic conditions than the CY 2011, but they appear to be in treatment at higher levels as well across several conditions. Since treatment rates are assessed among individuals with a condition this should be encouraging. While the CY 2014 group is sicker in some respects, they are self-reporting treatment at greater rates than the CY 2011 group.

Health-Related Lost Time

The magnitude of lost days per 100 FTEs due to chronic conditions was significantly higher in 2014 compared to 2011, a 195% increase per the table below. This suggests that the survey respondents were losing more time to absenteeism and presenteeism associated with their health conditions in CY 2014 than CY 2011, controlling for the same conditions. Major organizational changes, stressors in the environment, and other factors in the work climate may exacerbate the effects of conditions on lost time.

Table 4. Lost Days Due to Chronic Conditions (2011 and 2014)

Year	Lost Days per 100 FTE due to chronic conditions	% increase
2014	708	195.0%
2011	240	

Differences between employer values in CY 2014 and CY 2011

This section outlines differences between the employer-supplied values submitted in CY 2011 compared to CY 2014. The lost time values reported above are monetized using salary and benefits values supplied by the employer. The resulting monetized lost productivity is 297% higher in CY 2014 compared to CY 2011 per the table below.

Table 5. Monetized Lost Time (Lost Productivity)

Year	Monetized Lost Time (Lost Productivity)	% increase
2014	$51,147,102	297.7%
2011	$12,860,263	

These final monetized values are influenced by the employer-supplied values per the table below. The number of employees (headcount), benefits load and average payroll (payroll/headcount) were all higher in CY 2014 than CY 2011. Therefore, any lost time is valued at a higher level across organization in CY 2014 and CY 2011. Comparing non-monetized lost time is recommended when investigating differences between condition-by-condition results. But, for an overall estimate of the financial impact on the organization, the higher compensation levels and greater number of employees in CY 2014 does affect the monetized lost time across the whole organization.

Table 6. Employer-supplied values influencing Monetized Lost Productivity

Year	Payroll	% increase	Benefits Load	% increase	Headcount	% increase
2014	$1,096,191,070	29.5%	27%	22.7%	9890	14.6%
2011	$846,191,070		22%		8632	

Age-Related Differences in Health and Productivity

The number of respondents in the final sample is distributed as 246 employees age <=34 (30%), 263 employees age 35-49 (32%), and 319 employees age >=50 (38%).

Prevalence of Chronic Health Conditions by Age Group (2014)

This section focuses on the prevalence of chronic health conditions and their effects on lost productivity within each age group (comparing employees with any condition to employees without any condition for each age group) and between the three age groups (comparing only employees with one or more conditions in each age group to the other two age groups). To do this, the researchers compared HPQ-Select chronic health conditions by condition across age group and measured its impact on productivity (i.e. lost days). Table 7 below shows the prevalence of each condition across age groups and lost productivity, relative to condition.

Data provided in the table below are organized alphabetically by chronic health condition and by age group. Within each age group, data are provided for prevalence of the chronic health condition, percentage of those employees reporting the chronic condition who are currently in treatment, and the total lost productivity (calculated as the product of absenteeism and presenteeism and reported as lost days per 100 FTEs). Results for total lost productivity should be interpreted in comparison to respondents within the same age group who did not report the specific chronic health condition. For example, consider the chronic health condition of Allergy for the 35-49 year old age group; 62.4% of respondents in this age group reported having this chronic health condition, and 20.1% were in treatment for this condition. Compared to employees in the 35-49 year old age group who did not report having Allergy, employees 35-49 years old with Allergy had 42.38 (per 100 FTEs) more lost days of productivity. Some of the more notable differences have been highlighted.

- Allergy: there is significantly more lost productivity (596.11 days per 100 FTEs) in the oldest age group compared to middle age group (43.29 per 100 FTEs) and youngest age group (-145.78 per 100 FTEs)

- Bladder/Urinary: there is significantly more lost productivity (143.68 days per 100 FTEs) in the oldest age group compared to middle age group (-0.53 per 100 FTEs) and youngest age group (-3.46 per 100 FTEs)

- Depression: there is significantly more lost productivity (224.97 days per 100 FTEs) in the oldest age group compared to middle age group (9.62 per 100 FTEs) and youngest age group 111.65 per 100 FTEs)

- Fatigue: there is significantly more lost productivity (205.06 days per 100 FTEs) in the oldest age group compared to middle age group (1.77 per 100 FTEs) and youngest age group 65.59 per 100 FTEs)

- High cholesterol: there is significantly more lost productivity (132.67 days per 100 FTEs) in the oldest age group compared to middle age group (0.75 per 100 FTEs) and youngest age group (8.83 per 100 FTEs)

- Overweight: there is significantly more lost productivity (283.25 days per 100 FTEs) in the oldest age group compared to middle age group (6.55 per 100 FTEs) and youngest age group (153.91 per 100 FTEs)

- Sleeping problems: there is significantly more lost productivity (426.88 days per 100 FTEs) in the oldest age group compared to middle age group (-40.32 per 100 FTEs) and youngest age group -10.05 per 100 FTEs)

The trends seen in the data are that (1) health conditions are disproportionately impacting productivity among employees >= 50 years old; and (2) employees age 34-49 are indicating lower lost productivity compared to the other 2 age groups across the majority of conditions.

Table 7. 2014 Chronic Health Condition by Age Group with Lost Days

	Age group 1: <= 34			Age group 2: 35-49			Age group 3: >= 50		
Health Condition	**Prevalence**	**% in Treatment**	**Lost Days/ 100 FTEs (Total)**	**Prevalence**	**% in Treatment**	**Lost Days/ 100 FTEs (Total)**	**Prevalence**	**% in Treatment**	**Lost Days/ 100 FTEs (Total)**
Allergy	55.7%	12.4%	-145.78	62.4%	20.1%	42.38	70.2%	22.8%	596.11
Anxiety	17.5%	20.9%	63.62	15.2%	27.5%	-17.61	12.5%	30.0%	119.68
Arthritis	2.4%	50.0%	-27.80	12.9%	11.8%	-16.78	33.2%	21.7%	-25.09
Asthma	14.6%	27.8%	4.80	16.7%	43.2%	10.58	11.9%	52.6%	10.76
Back/Neck pain	21.5%	22.6%	28.52	28.5%	34.7%	17.93	35.7%	28.1%	-138.83
Bladder/ Urinary	5.3%	7.7%	-3.46	6.8%	22.2%	-0.53	10.3%	27.3%	143.68
Bronchitis	†	†	†	3.4%	11.1%	6.85	2.2%	42.9%	-13.54
Chronic pain	6.1%	33.3%	38.23	14.1%	24.3%	-0.05	18.2%	25.9%	-165.60
COPD	†	†	†	†	†	†	3.1%	60.0%	47.83
Coronary heart disease	†	†	†	18.6%	30.6%	-59.23	2.2%	28.6%	-54.33
Depression	19.1%	31.9%	111.65	3.8%	80.0%	9.62	18.5%	32.2%	224.97
Diabetes	20.7%	17.6%	170.75	21.7%	17.5%	-70.53	5.6%	83.3%	-0.93
Fatigue	8.1%	20.0%	65.59	9.9%	53.8%	1.77	22.3%	16.9%	205.06
GERD	15.4%	7.9%	38.12	18.6%	12.2%	-5.15	18.2%	46.6%	-91.17
Headache	6.1%	20.0%	11.58	18.6%	38.8%	-5.39	13.8%	9.1%	1.80
High cholesterol	8.1%	40.0%	8.83	19.4%	60.8%	0.75	32.3%	59.2%	132.67
Hypertension	12.6%	22.6%	4.52	12.2%	15.6%	-47.16	26.6%	82.4%	-36.84
Irritable bowel	19.5%	14.6%	-23.43	19.4%	17.6%	8.02	15.7%	18.0%	-54.38
Migraine	†	†	†	2.7%	0.0%	-6.05	17.9%	14.0%	93.11
Nicotine dependency	†	†	†	†	†	†	3.8%	0.0%	-27.45
Osteoporosis	†	†	†	2.3%	50.0%	-3.35	4.1%	38.5%	-11.00
Other cancer	2.8%	28.6%	11.67	4.6%	8.3%	-16.66	7.5%	62.5%	55.74
Other emotional problem	22.0%	16.7%	49.30	38.0%	14.0%	34.60	2.8%	33.3%	57.17
Overweight	24.8%	9.8%	153.91	4.2%	27.3%	6.55	36.1%	9.6%	283.25
Sleeping problems	2.4%	0.0%	-10.05	30.4%	12.5%	-40.32	35.4%	23.9%	426.88
Ulcer	55.7%	12.4%	-145.78	4.6%	16.7%	9.82	4.4%	21.4%	4.77

†<5 cases

Results Part V: Additional Nicotine Questions and Analysis

Introduction and Methods

The HPQ-Select survey asks participants to report nicotine dependence. In 2011, the researchers consulted with the DOE's Chief Medical Director and added two additional questions about nicotine use from the National Health Interview Survey (NHIS) to estimate the prevalence of smoking among employees[14]. The first question was "Have you smoked at least 100 cigarettes in your entire life?" and the second was "If yes, do you NOW smoke cigarettes?"

Analysis of the additional questions is presented in two parts. Part 1 addresses the tests of differences in proportions between Sandia National Laboratories (Sandia) and the CDC in four areas: ever smoked, currently smoke, and age and gender differences on each. Part 2 addresses the test of differences in proportions responding to the nicotine dependency question on the HPQ-Select compared to the additional smoking questions the researchers added (ever smoked, currently smoke). Results pertaining to currently smoking employees are based only on those respondents who indicated that they had ever smoked.

Part 1: Sandia National Laboratory Compared to CDC National Sample

Ever Smoked
Based on the CDC report, 41% of the sample (age 18 and older) reported ever smoking, compared to 22.5% for the 2014 Sandia sample and 23.4% for the 2011 Sandia. The difference between the CDC national report and the 2014 Sandia data is statistically significant (z=10.82, p<.001), with a smaller proportion of individuals who smoked in the 2014 Sandia sample as compared to the CDC national sample. The difference between the CDC national report and the 2011 Sandia data is statistically significant (z=10.79, p<.001), with a smaller proportion of individuals who smoked in the 2011 Sandia sample as compared to the CDC national sample. There is no significant different in proportion of employees who ever smoked between the 2014 and 2011 samples (z=.044, p=.65).

Current Smokers
Based on the CDC report, 20% of those who reported having ever smoked (age 18 and older) reported currently smoking, compared to 10.9% for the 2014 Sandia sample and 22.2% for the 2011 Sandia sample. The difference between the CDC national report and the 2011 Sandia data is statistically significant (z=6.55, p<.001), with a smaller proportion of individuals who smoked in the 2014 Sandia sample as compared to the CDC national sample. There is no statistically significant difference in proportion of currently smoking individuals between the CDC national report and the 2011 Sandia

[14] U.S. Centers for Disease Control and Prevention. (2007). National Health Interview Survey. Retrieved from http://www.cdc.gov/nchs/nhis/2007paradata.htm.

data is statistically significant (z=1.66, p=0.09), with a smaller proportion of individuals who smoked in the 2011 Sandia sample as compared to the CDC national sample. There is a statistically significant difference in proportions of employees who currently smoke between the 2014 and 2011 samples (z=6.82, p<.001), with a lower proportion of current smokers in the 2014 Sandia.

Table 8. Summary of Smoking Behavior Across CDC and Sandia Samples

	2010 CDC	2011 Sandia	2014 Sandia
Every Smoked	41%	23.4%	22.5%
Currently Smoking	20%	22.2%	10.9%

Age Differences
The only directly comparable result between Sandia and CDC is the relationship between age continuous and current smokers. According to the CDC, age was predictive of being a current smoker, with increasing age related to lower probability of being a current smoker. This result was not replicated in the 2014 or 2011 Sandia samples.

For the Sandia sample, age (continuous) was found to be a significant predictor of ever smoking in the 2014 sample (OR=1.05, p<.001) and in the 2011 sample (OR=1.04, p<.001), with the odds of ever being a smoker increasing with age. CDC only used a binary age variable (under 45 vs. over 45). For both 2014 and 2011 Sandia samples, age group (categorical) was not related to being a current smoker, but it was related to ever being a smoker. Individuals age 50 and older were more likely to have ever smoked (consistent with the results when using age as a continuous variable).

Gender Differences (Currently Smoke)
Based on the CDC report, 21% of men were current smokers, compared to 7.2% for the 2014 Sandia sample and 19% for the 2011 Sandia sample. A statistically significant lower proportion of male smokers were found in the 2014 Sandia sample as compared to the CDC national sample (z=3.89, p=.002).There was no significant difference between the national sample and the 2011 Sandia sample for men who currently smoke (z=0.38, p=.70). The difference in proportions of current male smokers in the 2014 and 2011 Sandia samples is statistically significant (z=2.42, p=.01), with a lower proportion found in the 2014 Sandia sample.

Based on the CDC report, 18% of women were current smokers, compared to 14.6% in the 2014 Sandia sample and 25% for the 2011 Sandia sample. These differences between the Sandia samples and the national sample are not statistically significant. Although there is a 10% difference in proportion of current female smokers between the 2014 and 2011 Sandia samples, this difference in not statistically significant.

Table 9. Summary of Smoking Behavior by Gender Across SANDIA and CDC Samples

	MEN			WOMEN		
	2010 CDC	2011 Sandia	2014 Sandia	2010 CDC	2011 Sandia	2014 Sandia
Currently Smoking	21%	19%	7.2%	18%	25%	14.6%

Part 2: HPQ Nicotine Dependence and Smoking Behavior

Nicotine Dependence and Employees Who Ever Smoked

Results from the 2014 Sandia sample show that 20.4% (*n*=165) of the respondents reported having ever smoked in the past, but only 12.7% (*n*=21) or those reporting past smoking stated they had ever been nicotine dependent. Results from the 2011 Sandia sample show that 21.9% (*n*=186) of the respondents reported having ever smoked in the past, but only 18.8% (*n*=35) or those reporting past smoking stated they had ever been nicotine dependent.

Nicotine Dependence and Current Smokers

Results from the 2014 Sandia sample show that 10.9% of employees having ever smoked report being current smokers (*n*=18), but only 38.9% (*n*=7) of current smokers stated they had ever been nicotine dependent. Results from the 2011 Sandia sample show that 22.2% of employees having ever smoked report being current smokers (*n*=41), but only 60.9% (*n*=25) of current smokers stated they had ever been nicotine dependent.

Table 10. Summary of Nicotine Dependence and Smoking Behavior

	Sandia 2011		Sandia 2014	
Nicotine Dependence	Ever Smoked (*N*=186)	Currently Smokes (*N*=41)	Ever Smoked (*N*=165)	Currently Smokes (*N*=18)
No	81.2%	39.1%	87.3%	36.4%
Yes	18.8%	60.9%	12.7%	63.6%

Discussion

This report summarizes findings from a health and productivity survey study at Sandia National Laboratories (henceforth, Sandia). First conducted in 2011, researchers used the Health and Productivity Questionnaire – Select (HPQ-Select) to assess the impact of chronic health conditions on lost work time and business costs. After several years, leaders at Sandia wanted to survey the workplace again, using the same measure, to once again assess the state of the workforce with regard to health and productivity, and where possible, compare results from the 2011 to 2014 samples. Results, whenever possible, were compared for the two samples, but interpretation of the differences should be done cautiously as the two samples represent different random samples of Sandia employees.

When the two random employee samples were compared (CY2011 and CY2014), it was clear to the researchers that the employees in the 2014 sample reflected more lost time associated with their chronic illness than employees in the 2011 sample. This greater impact of chronic illness on absenteeism and presenteeism drastically affected the overall lost work time and monetized lost work time costs for 2014. However, in addition to increased rates of absenteeism and presenteeism, Sandia also reported an increased number of permanent employees, increase in benefits load, and increase in average payroll as compared to 2011. These increases also influenced the higher monetized values reported in 2014. Therefore, it is recommended that Sandia focus on the non-monetized lost time when looking at differences between condition-by-condition results from 2011 and 2014.

While no national benchmarking statistics currently exist for health and productivity using the HPQ-Select, the researchers compared Sandia's 2014 results to the 2011 two-sample study they completed with Sandia and another DOE national laboratory. Results from that study showed total productivity losses as $57,949,749 (average for the two laboratories). This average lost productivity accounted for 4.2% of the total costs for the two sites, which is still higher than Sandia's current percentage of overall lost work time in 2014.

Similar to Sandia's results in 2011, the majority of health-related lost work time is due to presenteeism, as compared to absenteeism. However, in 2011, presenteeism accounted for 96% of total work costs and in 2014, presenteeism accounted for 81% of total work costs. The reason for the reduction in costs related to presenteeism cannot be determined from the data collected in this report; however, it is an interesting finding. After discussion with Sandia occupational health and wellness leaders, some of the results seen in this report may be due to a combination of the following factors: employee turnover, increased organizational stress, and increased focus on the early identification and treatment of health and wellness. Another reason might be a potential cultural shift that encouraged employees to feel more comfortable in 2014 using sick leave or other leave, thereby allowing employees to stay home when sick rather than coming to work sick and driving up costs related to presenteeism. These reasons cannot be confirmed in the data but do warrant further discussion among Sandia

leadership. Additionally, the 2014 sample included a greater number of female employees as did the 2011 sample. In general, women tend to be at greater risk for chronic health conditions and may have felt more comfortable disclosing their health conditions and negative effects on productivity on the survey. Another noteworthy organizational change is the fact that over the past several years, Sandia has replaced almost 40% of its total workforce. Many of the workers recently hired are in the older age group sampled in this study (50 years and above) and therefore, may have had more chronic health conditions and negative results from health problems on their productivity. Additionally, this group of relatively new hires may not yet be using all of the onsite health and wellness services offered to employees as much as more seasoned employees. While the researchers could not assess this with the anonymous survey, it is something to consider in future research.

The top five conditions that contributed to the most lost work time in the 2014 sample include Sleeping problems, Depression, Fatigue, Overweight, and Anxiety. Data from the 2014 survey show that 74% of all lost productivity is attributed to these top five conditions and the top 10 conditions account for 97%. These conditions are commonly observed as leading drivers of lost productivity in the health and productivity management literature. Due to the high prevalence of employees in this sample reporting having two or three of the following conditions: Sleep problems, Depression, and Fatigue, the researchers ran separate analyses to look at lost workdays among employees with these three conditions (7% of the total sample reported having all three conditions and 13% of the sample reported having 2 out of the 3 conditions). Results suggest that Sandia might consider focusing interventions to improve health and productivity with employees who have two or more of these three conditions for maximum cost-effectiveness.

With regard to Depression, which in the 2011 sample was the leading cause of lost productivity and now in the 2014 sample is the second leading cause, Sandia has been conducting onsite depression screening since 2010. While rates of depression have not decreased, based on the current sample, continued screening, paired with opportunities to treat depression onsite has increased. Sandia should continue to target depression as a key illness to identify and treat among employees, in combination with other comorbid conditions. Additionally, Sandia should consider working with its occupational health partners, like Employee Assistance and Wellness, to identify potential barriers to help-seeking behavior for depression. For example, once someone is screened positively for depression, are they following through with the referral for additional assessment and treatment? If not, what are the barriers that could be addressed at the time of screening and onsite intervention?

Similar to the 2011 sample, Sleep problems continue to be a costly health condition in the 2014 sample. Sandia is currently working on this problem with its partner health and wellness providers and they report having observed a negative trend regarding Sleep problems. Specifically, Sandia reports that partner programs have observed and increase in Sleep problems, which are also reflected in the 2014 sample. This is an area that should be carefully targeted and monitored in the future as it is a major cause of

lost productivity in the 2014 sample.

In the 2011 sample, Allergy, was one of the most prevalent health conditions reported, albeit not the highest driver of lost productivity. This trend continued in 2014. Additional prevalent conditions that are not being treated at a rate higher than about 20% most of the time include Back/Neck pain, Overweight, Sleeping problems, and Fatigue. It is important to continue to look for cost-effective ways to reach out to employees with these conditions and offer treatment.

Some of Sandia's onsite health programs, including programs for Hypertension, GERD, Chronic pain, Back/Neck Pain, and Diabetes, saw increased percentages of employees who reported having these problems, also reporting being in treatment. Areas where percentages in treatment stayed the same or slightly decreased in 2014, where onsite programs are available, included Sleep problems, Depression, Overweight, High cholesterol, Allergy, and Nicotine dependency. The researchers recommend that Sandia examine components of the programs, specifically outreach and engagement strategies, for the programs where treatment rates increased and compare to onsite programs where treatment rates remained the same or slightly decreased. There may be strategies used in the programs with increasing treatment percentages that could be adapted and used to promote and engage employees in the other programs. A potential positive finding in the 2014 sample as compared to the 2011 sample was that more employees in the 2014 sample reported being in treatment for any health condition overall (not just conditions with onsite treatment options) as compared to employees in the 2011 sample. Sandia might want to further explore what kinds of treatment employees are receiving, particularly for treatment offered offsite, and to help employees evaluate their treatment to see if intended outcomes from treatment are being achieved. If the onsite programs are helping to get employees who need treatment into treatment, than this is a positive finding, especially if the treatment they are receiving is of high quality.

Another positive change observed in the 2014 data, was with regard to lost work time due to Chronic pain and Back and neck pain. In 2011, Chronic pain was the 5th leading cause of lost work time; however, in 2014 it was 27th out of 29. In fact, employees who reported having Chronic pain in 2014 were *less* likely to be absent or report presenteeism at work. While prevalence for Chronic pain increased slightly (10.2% in 2011 and 13.3% in 2014) the percentage of employees in treatment for pain increased by almost 10%, which is a very positive finding.

As was done in the 2011, the sample was randomly selected, but stratified by age group. When employees from different age groups were compared within the 2014 sample, results suggest that employees in the older age group (50 years and older) and the younger age group (<= 34 years) are reporting increased lost workdays due to their health conditions as compared to middle-aged employees (35-49 years). While older workers clearly reported the most lost productivity due to chronic health conditions, it was surprising to see that younger workers, in general, reported more lost productivity due to chronic health conditions than middle-aged workers. Specific health conditions

where these trends were observed include: Allergy, Bladder/urinary, Depression, Fatigue, High cholesterol, Overweight, and Sleep problems. While many health promotion and treatment programs in the general public tend to focus outreach on middle-aged and older adults to prevent additional chronic conditions or to minimize negative effects of existing conditions, data from the 2014 sample clearly suggests that younger workers need to be included in chronic health condition outreach and treatment as well.

The final section of the report looked at Nicotine dependence rates and results were compared for the 2014 and 2011 samples. Overall, it appears that there are fewer smokers in the 2014 sample, and results are significantly lower than the national rates of smokers reported by the Centers for Disease Control and Prevention. This is a positive finding.

Strengths and Limitations

With any study there are always strengths and limitations to consider when interpreting results. As compared to the 2011 study, the overall response rate for the 2014 survey was much lower (43% in 2011 and 28% in 2014). The same methodology was used to survey the workplace; however, there may have been some survey fatigue due to the fact that a workplace-based safety survey was conducted only weeks prior to this survey. The researchers planned for the possible low response rate and therefore, the final sample yielded an adequate number of surveys to use in the analysis. When sample characteristics were compared to the actual employee demographics provided by Sandia, the 2014 random sample did have some significant differences when compared to the 2014 workforce data. Specifically, there were less women than expected in the sample, less workers in the service occupation category than expected, greater numbers of younger workers and lower numbers of middle-aged workers, and less employees making $25-49,000 per year and greater number of employees making $75-99,000 per year. While the majority of employee demographics were consistent with workforce estimates, results should still be interpreted cautiously with regard to the differences stated above.

A limitation that was known to Sandia and the researchers at the start of the study was the use of two different random samples to compare data over time. While the two samples are very similar based on age and other key demographics, we cannot conclude that they actually represent the group of random employees. Without the ability to assess individual change amongst employees over time, we are not able to confidently conclude what the changes observed between the two samples are actually due to. However, some potential reasons for the differences are provided above in the discussion section.

Conclusion

In conclusion, Sandia is to be commended for continuing their data-driven search for outcomes related to health and productivity. Data collected from this survey should be used to continuously monitor changes over time with employees. If Sandia is interested

in conducting a study that will allow measurement of change over time and causal relationship testing to see if employees who use onsite health and wellness services improve over time, a non-anonymous survey, conducted longitudinally, is recommended. Additionally, a survey where employees' identities are known to the researchers could then link data to biometric data, health-risk assessments, and other employee census or organizational data to better understand drivers of full costs and to identify specific opportunities to improve health and productivity.

Appendix

Appendix 1 - Profile of participating employer

Employer name:	Sandia (DOE)
Employer sector:	Other
Total gross revenue:	$2,686,329,000
Total payroll:	$1,096,191,070
Earnings (EBIDTA):	$0
Benefit load percentage:	27%
Med&Rx costs (incl dependents)	$140,395,624
Medical costs:	$124,650,000
Pharmacy costs:	$15,745,624
Headcount (Number of employees):	9,890
FTEs:	9,890
Sample survey participants:	828
Sample as % of workforce:	8%

	Sample (N=828)	Employer Overall (N=9,890)
Age		
<=34 years old	30%	21%
35 to 49 years	32%	45%
>=50 years old	39%	34%
Gender		
Male	57%	68%
Female	43%	32%
Occupation		
Executive, administrator, senior manager & professional	69%	69%
Technical support, precision production & craft workers	16%	14%
Sales, clerical & administrative support	12%	11%
Service occupations, operator & laborer	3%	6%
Income		
<$25,000/yr	2%	0%
$25,000 to $49,000	0%	9%
$50,000 to 74,000	21%	21%
$75,000 to 99,000	27%	22%
>=$100,000	50%	48%

Appendix 2 - Health status (ordered by health condition prevalence)

Health Status			
Health Condition		Prevalence %	% in Treatment
1.	Allergy	63.4%	19.2%
2.	Overweight	32.5%	12.6%
3.	Sleeping problems	30.7%	16.9%
4.	Back/Neck pain	29.2%	28.9%
5.	Fatigue	21.6%	17.3%
6.	High cholesterol	20.2%	49.7%
7.	Migraine	18.8%	15.4%
8.	Hypertension	18.8%	69.9%
9.	Depression	18.7%	31.6%
10.	Arthritis	17.6%	20.5%
11.	Headache	15.8%	9.9%
12.	Anxiety	14.9%	26.0%
13.	Asthma	14.3%	41.5%
14.	Irritable bowel	13.6%	18.6%
15.	Chronic pain	13.3%	26.4%
16.	GERD	12.6%	43.3%
17.	Bladder/Urinary	7.7%	21.9%
18.	Skin cancer	7.1%	23.7%
19.	Diabetes	3.9%	81.3%
20.	Ulcer	3.9%	15.6%
21.	Other cancer	3.7%	61.3%
22.	Other emotional problem	3.4%	21.4%
23.	Nicotine dependency	2.7%	0.0%
24.	Bronchitis	2.4%	20.0%
25.	Osteoporosis	2.1%	29.4%
26.	COPD	1.4%	50.0%
27.	Coronary heart disease	0.8%	28.6%
28.	Alcohol or Drug problems	0.7%	0.0%
29.	Congestive heart failure	0.2%	50.0%

Appendix 3 - Health status, absenteeism and presenteeism lost work time (ordered by total lost work days)

Health Status				Lost Time		
	Health Condition	Prevalence %	% in Treatment	Absenteeism Lost Workdays/100 FTEs	Presenteeism Lost Workdays/100 FTEs	Total Lost Workdays/100FTEs
1.	Sleeping problems	30.7%	16.9%	29.74	132.81	162.54
2.	Depression	18.7%	31.6%	19.14	114.34	133.49
3.	Fatigue	21.6%	17.3%	11.77	114.73	126.51
4.	Overweight	32.5%	12.6%	17.10	36.75	53.84
5.	Anxiety	14.9%	26.0%	0.50	48.92	49.41
6.	Bladder/Urinary	7.7%	21.9%	18.63	21.12	39.75
7.	Irritable bowel	13.6%	18.6%	3.98	29.92	33.90
8.	High cholesterol	20.2%	49.7%	6.40	25.46	31.85
9.	Other emotional problem	3.4%	21.4%	-1.25	31.50	30.25
10.	Headache	15.8%	9.9%	10.22	14.47	24.69
11.	Other cancer	3.7%	61.3%	2.77	12.96	15.73
12.	COPD	1.4%	50.0%	8.67	4.41	13.09
13.	Migraine	18.8%	15.4%	-2.72	14.83	12.11
14.	Allergy	63.4%	19.2%	-4.26	13.31	9.05
15.	Hypertension	18.8%	69.9%	4.96	3.26	8.22
16.	Asthma	14.3%	41.5%	10.35	-3.20	7.16
17.	Skin cancer	7.1%	23.7%	0.47	6.06	6.53
18.	GERD	12.6%	43.3%	-0.98	6.01	5.03
19.	Alcohol or Drug problems	0.7%	0.0%	-1.19	4.06	2.87
20.	Diabetes	3.9%	81.3%	7.38	-5.06	2.32
21.	Bronchitis	2.4%	20.0%	4.78	-6.56	-1.77
22.	Nicotine dependency	2.7%	0.0%	0.84	-2.68	-1.84
23.	Congestive heart failure	0.2%	50.0%	-0.21	-2.17	-2.38
24.	Chronic pain	13.3%	26.4%	7.41	-10.12	-2.72
25.	Arthritis	17.6%	20.5%	-9.83	1.56	-8.27
26.	Ulcer	3.9%	15.6%	0.78	-9.72	-8.94
27.	Osteoporosis	2.1%	29.4%	-9.92	-0.05	-9.97
28.	Coronary heart disease	0.8%	28.6%	-2.19	-7.93	-10.12
29.	Back/Neck pain	29.2%	28.9%	-0.18	-14.58	-14.76

Appendix 4 - Health status, lost time and lost productivity (ordered by lost productivity amount)

Health Status				Lost Time			Lost Productivity**	
	Health Condition	Prevalence %	% in Treatment	Absenteeism Lost Workdays/100 FTEs	Presenteeism Lost Workdays/100 FTEs	Total Lost Workdays/100FTEs	Lost Productivity/100 FTEs	% of All Lost Productivity
1.	Sleeping problems	30.7%	16.9%	29.74	132.81	162.54	$118,802	23.0%
2.	Depression	18.7%	31.6%	19.14	114.34	133.49	$97,566	18.9%
3.	Fatigue	21.6%	17.3%	11.77	114.73	126.51	$92,463	17.9%
4.	Overweight	32.5%	12.6%	17.10	36.75	53.84	$39,353	7.6%
5.	Anxiety	14.9%	26.0%	0.50	48.92	49.41	$36,117	7.0%
6.	Bladder/Urinary	7.7%	21.9%	18.63	21.12	39.75	$29,052	5.6%
7.	Irritable bowel	13.6%	18.6%	3.98	29.92	33.90	$24,775	4.8%
8.	High cholesterol	20.2%	49.7%	6.40	25.46	31.85	$23,280	4.5%
9.	Other emotional problem	3.4%	21.4%	-1.25	31.50	30.25	$22,109	4.3%
10.	Headache	15.8%	9.9%	10.22	14.47	24.69	$18,045	3.5%
11.	Other cancer	3.7%	61.3%	2.77	12.96	15.73	$11,500	2.2%
12.	COPD	1.4%	50.0%	8.67	4.41	13.09	$9,565	1.8%
13.	Migraine	18.8%	15.4%	-2.72	14.83	12.11	$8,853	1.7%
14.	Allergy	63.4%	19.2%	-4.26	13.31	9.05	$6,618	1.3%
15.	Hypertension	18.8%	69.9%	4.96	3.26	8.22	$6,007	1.2%
16.	Asthma	14.3%	41.5%	10.35	-3.20	7.16	$5,231	1.0%
17.	Skin cancer	7.1%	23.7%	0.47	6.06	6.53	$4,770	0.9%
18.	GERD	12.6%	43.3%	-0.98	6.01	5.03	$3,675	0.7%
19.	Alcohol or Drug problems	0.7%	0.0%	-1.19	4.06	2.87	$2,095	0.4%
20.	Diabetes	3.9%	81.3%	7.38	-5.06	2.32	$1,696	0.3%
21.	Bronchitis	2.4%	20.0%	4.78	-6.56	-1.77	$-1,297	(0.3%)
22.	Nicotine dependency	2.7%	0.0%	0.84	-2.68	-1.84	$-1,342	(0.3%)
23.	Congestive heart failure	0.2%	50.0%	-0.21	-2.17	-2.38	$-1,741	(0.3%)
24.	Chronic pain	13.3%	26.4%	7.41	-10.12	-2.72	$-1,986	(0.4%)
25.	Arthritis	17.6%	20.5%	-9.83	1.56	-8.27	$-6,046	(1.2%)
26.	Ulcer	3.9%	15.6%	0.78	-9.72	-8.94	$-6,533	(1.3%)
27.	Osteoporosis	2.1%	29.4%	-9.92	-0.05	-9.97	$-7,288	(1.4%)
28.	Coronary heart disease	0.8%	28.6%	-2.19	-7.93	-10.12	$-7,395	(1.4%)
29.	Back/Neck pain	29.2%	28.9%	-0.18	-14.58	-14.76	$-10,786	(2.1%)

*** The lost productivity model is based on the assumption that there are 260 workdays available per year.*

** When negative values are reported individuals with the condition have fewer lost workdays than individuals without the condition.*